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JOINT EXPERIMENTATION RESULTS
FROM
FLEET BATTLE EXPERIMENT FOXTROT

Gordon Schacher
Shelley Gallup
Richard Kimmel
Michael Sovereign

The Institute for Joint Warfare Analysis
Naval Postgraduate School
Monterey, California

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INSTITUTE FOR JOINT WARFARE ANALYSIS
NAVAL POSTGRADUATE SCHOOL
Monterey, California

RADM David R. Ellison
Superintendent

Richard Ester
Provost

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This report was prepared by:

Institute For Joint Warfare Analysis
Naval Postgraduate School
Monterey, CA

Authors:

Gordon Schacher

Shelley Gallup

Richard Kimmel

Michael Sovereign

Reviewed by:

GORDON SCHACHER
Director
Institute for Joint Warfare Analysis

Released by:

DAVID W. NETZER
Associate Provost and
Dean of Research

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13. ABSTRACT (maximum 200 words)

Fleet Battle Experiments produce information that is relevant to Joint Experimentation Objectives and Issues. This report presents an extraction of Joint Experimentation pertinent information from Fleet Battle Experiment Foxtrot.

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APPENDICES

1.0 INTRODUCTION

This report is an extraction of results from Fleet Battle Experiment Foxtrot (FBE-F) which address Joint Experimentation issues. This introduction describes the extraction process (very briefly), the data/information structure, and the report format.

FBE data are at several levels and occur in many forms.

1. Electronic System Performance Data
2. Electronic Process Timeline Data
3. Event Data
4. Subjective Observations of Events
5. Subjective Observations of System Performance
6. Subjective Observations of Process Performance
7. Subjective Observations of Operational Capabilities

These data are rolled up into various types of information and results, which fall naturally into levels, roughly represented by:

A. System Component Performance
B. System Performance
C. Process Capabilities
D. Process Requirements
E. Operational Capabilities
F. Operational Requirements
G. TTP and CONOPS Evaluations and Recommendations
H. Doctrine Evaluations and Recommendations
I. Plans and Programs Recommendations

The results in this report cover B through F.

An abbreviated description of developing various levels of findings and results from the data follows. The basic data are sorted into topical categories that identify operational issues, system, scenario, etc. The best way to illustrate this is with a diagram and example:

Concept	Scenario
Processs	System

→

TCT	Pop-Up TEL
Flat C2	Sensor

This illustrates (simplistically) how a given datum is cataloged. The concept that was being tested during the experiment was Time Critical Targeting, and the effectiveness of a flattened Command and Control structure. The particular scenario being used when the datum was obtained was prosecuting pop-up TELs, specifically MSEL #7. The datum refers to the sensor system.

The particular sensor datum could be any one of the forms listed above. It could also be any of a wide variety of types, such as

sensor characteristics,	sensor control,	BDA prioritization,
information pipeline,	digital target folders,	etc.

The first step in the analysis process is to place data into categories. The next step is to decide how one wishes to bin the data. Using the above diagram, a bin could be TCT, flattened C2, TELs, and one of the above, such as sensor control. All data that matches this bin is pulled together, regardless of form, and synthesized into a finding, or set of findings. These are the findings that are presented in the bulk of this report, Sections 3 to 7.

These findings are related to Joint Experimentation concerns. This is done by correlating each set of findings with specific Joint Experimentation Objectives and Initiatives. The correlations are indicated in Bold in those Sections, and in a matrix in Appendix B.

These detailed findings are interesting and have many uses. However, they are normally to detailed, and at too low a level, to be reported out of the experimentation or systems engineering community. Thus, another step is used to further synthesize these findings into principle results. Principal results are presented in Section 1.

The final step in the Joint Experimentation reporting process is to decide which of these principal results will be reported as Joint Lessons Learned. This step is not included in this report.

This report also contains contextual material. Appendix A is a description of FBE-F. Appendix C is the Data Capture Annex from the Experiment Plan.

2.0 PRINCIPLE FINDINGS

The principle findings from FBE-F that are pertinent to Joint Experimentation concepts and issues are presented here. Each principle point contains a small body of synthesized information. The topical areas that make up these points are:

1. Maritime Access
2. Sensor Management
3. ISR Desk Manning and Procedures
4. ISR Equipment Requirements
5. Sensor Information Processing and Targeting
6. Platform Management of Sensors
7. Sensor Related CROP Issues
8. Time Critical Targeting Issues
9. Time Critical Targeting CROP Issues
10. Organization Relationships
11. Effects Based Operations
12. Asymmetric Threat Management
13. Common Tactical Picture versus CROP for TCT
14. Parallel Targeting Processes
15. TCT Information and Fusion
16. Joint Fires Element Structure
17. Parallel Operations and Coordination

There is nothing absolute nor special about this list of topical areas. One could easily utilize a different grouping of principle results. The only criterion is that they correspond to Joint Experimentation interests. Also, the principle results are not necessarily complete. There is a great deal of information in this report that has not been pulled into these results. Another analyst could well feel that additional principle points should be generated. Finally, the principle findings are not independent. Some could be combined, and how to further refine them depends on the joint lessons-learned format that is being built.

One should remember that this report is for a single FBE. Results important to Joint Experimentation occur in all FBEs, and synthesizing results across a number of FBEs is needed to gain complete understanding of an issue. For example, Foxtrot focused on a centralized process, the Joint Fires Element, while Golf focused on a flattened C2 structure. Comparing the results from the two provides much additional information over examining the experiments in isolation. In the spirit of this philosophy, a report on Time Critical Strikes and Fires, which synthesizes results across all FBEs up to Golf, has been produced.

It is important to be able to trace synthesized information to the sources. Thus, each of these principle findings has an reference to the source material from within this report. To trace to more basic material, one must go to the original FBE-F report and also its underlying data.

MARITIME ACCESS (Sections 5.3.2.3, 5.4.2)

More rapid access to littoral areas is required for future operations. Mine clearing and attendant Joint protection of mine clearing forces from threat are key components to success. Concurrent operations with organic assets and protection by joint forces were tested.

Co-location of the Sea Combat Commander (SCC) and the Mine Warfare Commander (MIWC) with the Joint Forces Maritime Commander (JFMCC) was effective. The result of this collaboration was an integrated Undersea Warfare Plan, coordinated within the framework of other Naval operations. This collaboration should be formalized.

Mine clearing requires the creation of a protective zone around mine clearance (MCM) forces. Protective forces need to know the location of MCM forces and MCM forces need to know the threats, where the protective forces are located, and the status of any engagements. This requires increased situational awareness on board MCM forces as well as increased visibility to the remainder of the joint force. Current C4I does not support either requirement.

The vulnerability of MCM forces can be mitigated by integrating fires to shore based threats and suppression of asymmetric threats posed by surface craft. Army Attack Aviation (e.g. Apaches) appear uniquely fitted to the role of engaging surface threats. To realize this potential many essential questions including airborne C2, ability of the Apaches to discriminate between friendly and hostile targets and crew training require resolution.

SENSOR MANAGEMENT (Section 4.3.2.1)

Centralized management of sensors was a focus of experimentation. An Information, Surveillance, and Reconnaissance (ISR) desk was formed and performed this function within a Joint Fires Element (JFE) which provided centralized control of fires.

The result of having the JFE as an overarching capability was a more rapid fires process than is normally obtained by sending less processed sensor information to component commanders.

The ISR anchor desk provided an important new capability for local collection management, making it possible to deal with TCTs more expeditiously. The Attack Guidance Matrix (AGM) was a useful tool but it needs to be modified to make it a collection management and execution aid. The desk allowed parallel sensor, target location and identification, and weapon target-pairing processes.

The JFE concept improves dynamic response to emerging threats, such as TCTs, through centralized management of assets. The time scales of information available to this function need to be modified to match the pace of its operation. Examples are a dynamic target list rather than an AGM, also an Integrated Tasking Order (ITO) and Modernized Information Data Base (MIDB) that are refreshed in time-step response with the tactical situation.

The JFE needs a complete tactical picture in order to perform its function. This may be beyond what would normally be provided by a CROP. For example, JFE needs projected tracks of sensors. It also needs cradle-to-grave information about threats, including those which haven't been adequately mensurated nor designated as targets, and the results of BDA.

Doctrinal changes, such as the inclusion of the J2 and J3 watches in the JFE and improved interoperability should be explored. This would allow real-time fusion of current intelligence and sensor information.

ISR DESK MANNING AND PROCEDURES (Sections 4.3.2.2, 4.3.2.11)

Because it can be a focal point, considerable attention to ISR desk manning, responsibilities, TTPs, etc. are needed. A possible methodology is a sensor plan developed in parallel with the ITO followed by ISR desk managing by exception.

TTPs are needed for sensor control that are responsive to the dynamic tactical situation. It is unclear how control of sensors should change as tactical requirements change.

The ISR desk needs to manage tactical sensors as organic assets. This requires access to the same platform information available to the JFACC and real-time coordination of those platform's assignments.

Two-way communication between the UAV sensor controller and the ISR desk reduced the nomination time-lines, implying an increase in efficiency of TCT prosecution.

UAV pictures and location data aided targeting but command relationships and control doctrine between the ISR desk and the UAV controller need to be defined.

JFE EQUIPMENT REQUIREMENTS (Sections 4.3.1.1, 4.3.2.2)

The JFE utilized the GISRS-M workstation for sensor information fusion and preparation of target folders, PTW+ for target mensuration, and LAWS for weapon-target pairing.

There were bottlenecks at various points in the targeting process, e.g. GISRS transmission via smtp taking 30sec to 10min or three GISRS workstations overwhelming the PTW+ station. This indicates that extending this configuration to handle a full tactical area will require careful examination of information loads at the choke points. Balancing the number of GISRS-M, PTW+, and LAWS terminals and improving their interoperability is required to eliminate bottlenecks, especially if the sensor/information process becomes more efficient.

Three ISR stations were planned to receive all of the ISR sources (including live and simulated). Processing system performance depended upon the capability of the system to receive sensor inputs and add them to the comparisons performed at the next level of the system by LAWS and PTW+. An optimal ratio of system components to sensor feed in this integrated systems

architecture should limit queuing conflicts so that no TCT is left unserviced due to "bunching up" of target nominations.

Originally three (3) PTW+ units were to be part of the JFE, however only one was employed in the experiment. The result was a backlog of sensor target nominations at PTW+.

Analysis of optimal technology mix should be the focus of additional experimentation. In general, in the context of this experiment it seems that the required ratio for system performance within TCT dwell times should have been on the order of one ISR desk forwarding target nominations to one PTW+. This one to one relationship does not necessarily imply the same ratio with respect to LAWS.

SENSOR INFORMATION PROCESSING AND TARGETING (Sections 4.3.1.2, 4.3.2.4)

The experiment sought to determine what types of information, what quality, and to whom were needed for timely TCT operations. These results are independent of the fires system structure.

The full system does not provide sufficient information to do an adequate assessment of target location error (TLE), which is necessary for improved targeting. This degree of centralized processing requires more information about sensors and platforms than is normally provided. Real-time telemetry of this information needs to be provided with imagery. Fusing sensor data can require inclusion of this information.

None of the sensors provided a TLE adequate within the rules of engagement (ROE) to shoot on. They all had to go through the PTW+ for precision targeting. This resulted in a stovepipe process, a serial one if the target was introduced from sensor information.

Target mensuration is greatly aided by multiple resolution imaging. However, passing full images for all possible targets overloads the system. A decision process is needed that restricts the amounts of information passed to the fires cell. Several actions could aid this situation:

Pass hyperlink references to images rather than the images.
Resolve ambiguity and duplication at the ISR desk before passing nominations.
Use the Attack Guidance Matrix and forward nominations based on priority.

Imagery resolution is a critical variable to system performance. Resolution which does not meet system parameters (in this case the AGM) required for direct weapon target pairing in LAWS (or JCSE) requires further processing by PTW+. Nearly refined images require less processing here than those needing extensive mensuration.

PTW+ can reduce mensuration timelines. However, in addition to low imagery resolution, timelines may be adversely impacted by low correlation to Intelligence Products Library (IPL) data, or by limited access to IPL. Limited access is typically related to inadequate data storage immediately accessible to the PTW+ operator.

Related to the comment above, the Modernized Integrated Database (MIDB) may not contain necessary data to construct TCT aimpoints. At issue here are the variable rates at which the MIDB may be refreshed at different locations.

PLATFORM MANAGEMENT OF SENSORS (Section 4.3.2.8)

Sensor managers on platforms and UAV controllers need to observe sensor output in order to provide efficient sensor management and to insure information quality. They also need to be in communication with the ISR desk so that real-time coordination between sensor data, not just sensor assignment and location, and information requirements can be accomplished.

SENSOR RELATER CROP ISSUES (Section 6.4)

There is a tendency to think of the CROP as supplying only target and platform information. Management of sensors so that the fires process can meet TCT timelines requires that the CROP contain a variety of sensor information.

Incorporate a means for generating and displaying ISR collection routes in the ISR situational awareness display.

Immediately pass track reports to operational nodes for "see and avoid" while TCT nomination is ongoing.

ISR needs to know from Operations the status of TCT nominations as a driver to collection and processing refinement.

A system and process is needed to distribute all airborne imagery in real-time rather than some sensor information processing waiting until aircraft return to the carrier.

At all stages of the targeting process, there should be available a target management/status function that shows priorities, target flows, and situational awareness.

Need 100mb ethernet minimum for build/distribute CROP.

The ISR desk needs a real-time CROP containing the following to support the TCT process:

- Video from UAV and P-3
- Tactical Data Link information on friendly/hostile force locations
- NITF imagery from tactical, theater, national sources
- TCT nominations
- Uncorrelated near real-time SIGINT information
- JSTARS (APY-6)/GMTI track information
- Cradle-to-grave information on all targets, up to final BDA
- Non actionable targets

TIME CRITICAL TARGETING ISSUES (Section 6.3)

Fixed TCTs can have much of the targeting information prepared in advance. For moving targets the task is much lengthier because the interpretation, location, identification and mensuration must be established, and the assessment of collateral damage and ROE must be performed after the detection of the target. This information is not possible to file ahead of time so an electronic target folder must be built before the target can be authorized for attack.

There may be a long period between when the first sensor is alerted and the actual detection of a potential target since Automatic Target Recognition (ATR) is still relatively ineffective. Therefore moving or relocatable targets are quite difficult to target within the usual TCT thresholds of between 5 minutes and a few hours, almost regardless of the weapon being used.

For effects-based prioritization, re-tasking of strike platforms, and deconfliction the targeting net must include a node with broad understanding of the current status of the operations and with authority not only to direct fires but to re-task platforms that are performing lower priority missions. This must be a fairly powerful node with quick access to responsible command levels.

Such a command node must be supported by a good CROP as well as the much more restricted targeting net(s) and have extensive intelligence support from national sources, probably through a Joint Intelligence Center. In a large-scale joint or coalition operation this node will have to have be at the JTF level and have the commanders personal blessing because of the necessity of intervening in on-going missions in order to respond to TCT as well as high priority for intelligence collection and sensor management.

One of the demands for responsive intelligence collection and interpretation is that for any type of TCT target and weapon it is important that BDA be obtained in order to decide when to stop firing. Because TCT are so important, re-strike will be necessary until confirmation that the desired effect on the target has been reached. The planning of BDA should occur with every fire mission pairing. Otherwise it is likely that the BDA will be delayed, useful information for restrike decisions will not be provided, and many weapons will be wasted.

TIME CRITICAL TARGETING CROP ISSUES (Section 6.3)

The CROP did not provide adequate information support for targeting of TCTs. There are problems with latency, completeness, and accuracy. A Land Attack TCT CROP, if it were to exist, should have additional information, such as:

- Sensor data: sensor location, target location error, footprint and pointing data
- Full TADIL information and track history for each target
- Imagery: video from UAV with telemetry info and NITF images
- Related near-real time SIGINT and possibly COMINT, MASINT
- GMTI track (JSTARS) info and position location info (tags) concerning targets
- Information concerning the firing status of friendly units

Representation of the priority of the targets
Confirmation of authority to fire

The CROP may not practically provide all necessary targeting information. A combination of IPB and dynamic targeting folders, direct sensor- weapon threads and perhaps some specific targeting nets is likely to be crafted for specific land attack scenarios rather than a general purpose broadcast of all targeting information. The reasons for this, in general, is that the targeting information is specialized by type of weapon and is often restricted in its releasability / dissemination both for classification and simply because of geographical relevance and sensitivity.

The authorization for attack of some potential targets and use of some of the weapons is likely to be reserved to specific levels of command which may desire to limit visibility into their operations, for security and other considerations.

ORGANIZATION RELATIONSHIPS (Section 7.1)

The role of the Guidance, Apportionment and Targeting (GAT) ashore was to coordinate JFMCC efforts with the JFE, represent the JFMCC at the ECB and the JTCB and in all other domains. A liaison officer from JFMCC was assigned. (GAT) set up ashore did not overcome a command and planning barrier which resulted from concerns by the JFE that although they were working with the GAT, in actuality they were speaking to the JFMCC. In other words, the GAT ashore carried the weight of the JFMCC. This was potentially a good situation except in the condition in which the GAT was not adequately linked to the JFMCC's intentions and concerns. There is evidence that this was the case early in the experiment, but that the situation improved as the experiment and connectivity continued.

Improved connectivity was noted between days 3 and 4, producing a potential for JFMCC/JFE coordination which shifted perceived responsibility of the JFMCC GAT ashore directly to the JFMCC. This resulted in a very close coupling between JFMCC and his warfare commanders, and the planning and execution planning cycle being conducted ashore in the JFE/Fires cell. This is evidence of synchronization, and of organizational learning. This also highlights that the GAT role need not be institutionalized throughout the life of the operation, but be phased in and out of the ops as the organizations involved develop the competencies to engage strategic and tactical problems in a distributed environment.

EFFECTS BASED OPERATIONS (Section 8.3)

The integration of effects based operations (EBO) was not effective largely due to a lack of common understanding of EBO, a common language and failure to adequately define the requirements for detailed, continuous commander's guidance. Organizationally future JFEs must include a feedback loop, a method of evaluating actions or potential actions effects (particularly those directed at reason and belief) and a construct to employ non-kinetic effects.

FBE Foxtrot explored processes related to the tactical level of "effects-based targeting." The JFE organization was defined to implement this concept. Effects at *operational* and *strategic* levels will likewise require congruent organizations, and associated doctrine and TTPs, if EBO is to be implemented. Synchronization between the levels requires exploration.

Sensor management of battle-space and national assets in FBE Foxtrot did not include adequate real-time BDA, essential to associating effects between tactical and operational levels. Inclusion of this system element will require additional asset management control by the JFE, and likely increase the number of sensors and associated C4I.

The battle-space must be understood as a complex and dynamic system. In order to implement EBO it will be necessary for "planning" to identify expected/desired primary and secondary effects. Both levels of effects should be presented and promulgated in a document such as the ITO as guidance for an effects control board. Such planning guidance should also include directed flexibility, such as "if this effect is accomplished then that change in operations is implied," which is really a sophisticated prioritization scheme that is effects based.

ASSYMETRIC THREAT MANAGEMENT (F report)

The encompassing nature of NBC Defense and the extensive requirements that this would have placed on the CJTF could overwhelm the warfighting capability of the staff. The experiment illuminated the extent of the demands of maintaining a coalition, ensuring host nation support, evacuation of US nationals and the burden of conducting operations in an NBC environment.

COMMON TACTICAL PICTURE VERSUS CROP FOR TCT (Section 6.3)

The information requirements for a successful Joint Fires Element clearly go far beyond the current capability of the CROP. The CROP is first of all a situational awareness tool. As such it must cover a broad area such as a theatre and is literally a picture in order to enhance comprehension. It therefore has a limited level of detail and less than instantaneous latency. It is a joint and often a coalition service that must be available to those with only Secret clearance or often even less.

PARALLEL TARGETING PROCESSES (Section 6.3)

In the case of a moving or relocatable TCT with short thresholds, the only hope for successful execution is that an imaging sensor is under the control of (or in direct support of with very good connectivity) the JFE fires planners (LAWS in Foxtrot). In Foxtrot a simulated UAV was available to the GISRS-M operators and the UAV sensor display was available locally. It was therefore possible to locate, with some degree of accuracy, and to identify the TCT. Because LAWS had sporadic information on status of friendly firers, it could begin to assess firing options while the target was being mensurated and a reasonably rapid firing assignment that was likely to be feasible could be made.

Authorization of higher levels was not necessary in Foxtrot simulations and firers were supposed to report back via LAWS when performing the simulated execution. Thus the firing loop could conceivably be closed in a reasonably short period. In effect the Video from the UAV plus its controls became a targeting net supporting LAWS.

TCT INFORMATION AND FUSION (Section 6.3)

The information to support TCT targeting and weapon assignment depends upon the combination of target type and weapon type that are being paired. Although having all the information necessary for targeting (all types of weapons might facilitate the most efficient pairing of weapons and targets) for TCT, it is much more important to be able to quickly make a feasible pairing with the information in hand than to wait for all information on which to base an optimal choice.

From the sensor standpoint, often TCT sensor provides some kind of imagery: video from a UAV, national SAR or EO imagery. This generally allows rapid identification and reasonably accurate location but may require mensuration. Other times the TCT sensor is only an IR launch warning or SIGINT event or HUMINT / MASINT report. It is anticipated that JSTARS like capabilities will provide TCT over land and that distributed ground / water sensors will also provide detection (and identification in some cases). Generally a fusion of this information or correlation with imagery is necessary before the target location and identification will reach acceptable completeness for attack.

JOINT FIRES ELEMENT STRUCTURE (Section 6.2, 7.2)

The concept of a Joint Fires Element (JFE) was perhaps the most promising innovation in Foxtrot. It consisted of a sensor grid (ISR cell with feeds from national , theatre and organic sensors) supported by a GISRS-M terminal, an information grid (targeting cell with MIDB target data base) supported by a PTW+ terminal and an engagement grid (fires coordinator) supported by a network of LAWS terminals. In particular GISRS-M provided an important new capability for local collection management that makes it possible to deal with Time Critical Targets (TCT) much more expeditiously when combined with LAWS and the PTW+. Connectivity to the UAV controller was particularly important in tracking of moving TCTs.

The concept of an Attack Guidance Matrix (AGM), borrowed from the US Army, was explored to aid in EBO and in reducing the timeline for TCT. This is a promising concept but depends upon accurate capability to estimate target location error and system response time as well as a stable assessment of target priorities . Additional testing and doctrinal development is needed as well as Joint interoperability. TCT suffered from lack of visibility by all participants into the status of Blue response since a sample showed that only about half of TCT designated targets were attacked.

The AGM was useful to the GISRS-M operators but adaptation to a collection planning and execution aid is desired. Doctrinal changes such as the integration of the J-2 and J-3 watches and improved interoperability should be explored. Balancing the number of PTW+, LAWS and GISRS-M terminals and improving their interoperability is required to eliminate bottlenecks when they are not co-located as they were in Foxtrot.

Because Foxtrot focused on the non-aviation resources to respond to TCTs, there was a perception of the need for a Guidance, Apportionment, and Targeting cell (GAT), or set of processes, that would ensure that the JFEs actions to pursue TCTs are in accordance with the commander's guidance, do not conflict with other uses of the Naval resources, and strike an appropriate, not simply a feasible, set of targets, i.e. the GAT processes. For example, it would be desirable to have an authority to approve the assignments by the LAWS operators of weapons to targets (or at least someone at a higher level to discuss the issues that might be involved in a timely manner). A GAT cell, if it existed and had doctrinally defined functions and authority, could provide such support. The guidance, apportionment and targeting processes have traditionally focused on pre-planned operations and the ATO. When TCTs become important and the ATO is impacted, there is no current approved doctrine for how this is to be handled. [In fact the Joint doctrine status board reports that the development of Tactics, Techniques and Procedures (TTP) for Time Sensitive Targets is being separated from the draft publication JP 3-60 Doctrine for Joint Targeting as JP 3-60.1 JTTP for TST.]

PARALLEL OPERATIONS AND COORDINATION (Sections 5.3.2.1, 5.3.2.2)

Although co-locating the MIWC with the JFMCC and Sea Component Commander (SCC) on the same platform is contrary to network centric operations, centralizing the decision making process did provide opportunities to observe the interaction at various staff levels across this continuum. Close interaction between these key decision-makers was important and productive for parallel MIW/ASW operations.

Hence, it is important for the MIWC and SCC to cultivate a relationship and share relevant information at the Warfighter commander level so that each maintains the appropriate situational awareness.

An effective C^2 process between warfare commanders similar to the structure exercised during FBE-F is important for information exchange and cross-pollination of the two disciplines. Although a common operational picture should be tailored to each commanders need, in a decentralized environment, it would be beneficial during parallel operations, for the SCC to access the MIW picture and for the MIWC to access the ASW/USW picture so that each is cognizant of the complete battlespace.

Without robust distributed collaborative planning tools, decentralizing the decision-making is a difficult task. A common operational picture (COP) plus the effective C^2 process established between the MIWC and SCC staff's enhanced the relationship of the two organizations. Also, situating both MIW and SCC staff watch-standers in close proximity enhanced the utility of the common situational awareness and provided an environment for dynamic information sharing.

In the organizational structure implemented for the experiment, the MIWC was positioned to identify requirements and advise the JFMCC on the critical MIW related local battle space issues. MIW is a time consuming warfare area, especially early in the conflict. Hence, the MCM force in JMAC must be able to conduct operations in parallel with the JFMCC campaign plan to gain control of the seas. It is important that the MIWC help focus JFMCC attention to the various phases of this critical operation.

Of equal importance throughout the developing scenario was the role of the SCC, who was primarily focussed on situational analysis and providing the JFMCC with information required for ASW/USW decision making. The organizational structure during this experiment created a dynamic that encouraged a continuous interaction between the MIWC and SCC that proved to be quite beneficial. With both working as subordinate warfare commanders to the JFMCC, the speed of command in resolving support and supporting requirements was achieved.

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3.0 JOINT EXPERIMENTATION OBJECTIVES AND ISSUES

The following are the Experimentation Objectives, their hypotheses, and the Issues that were addressed by Fleet Battle Experiment Foxtrot. Data was not obtained for all of the all of the Issues. Those Issues for which data were gathered will be shown in the individual Objectives sections.

3.1 E01 – ATTACK OPERATIONS AGAINST CRITICAL MOBILE TARGETS

Hypothesis: IF we can detect, engage, and destroy critical mobile and time sensitive targets, THEN we can protect the joint force against increasingly lethal conventional weapons and weapons of mass effects, achieve a significant combat power advantage over the adversary, and limit conflict escalation.

Issue 1. What degree of confidence is required (or acceptable) by a JFC to automatically identify and attack critical mobile targets?

Issue 2. What is the most appropriate C2 structure to satisfy the time restrictions posed by attacking critical mobile targets?

Issue 4. Will the interaction of future sensors and sensor exploitation technologies, future command and control technologies, and future weapon systems contribute to an effective attack operations system?

Issue 5. Can systems be designed to provide dynamic tasking and re-tasking of rapid, long-range, accurate and flexible air, land, and sea engagement systems?

3.2 E03 – RAPID DECISIVE OPERATIONS

Hypothesis: IF a highly deployable, lethal, agile, survivable, and supportable force can conduct a deep operational strike against the enemy's operational center of gravity, THEN we can coerce our opponent into conceding without having to conduct a protracted campaign.

Issue 1. What are the information requirements available to the JFC?

Issue 2. What are the information generating assets available to the JFC?

Issue 4. How is the information for the JTF managed, coordinated, and distributed?

Issue 5. Were Critical Information Requirements (CIR) identified for the JTF?

Issue 6. How quickly were CIRs passed?

Issue 7. How were the CIRs filtered so the CJTF only received info critical to decision making?

Issue 8. What planning, decision, and execution support tools were used by the JTF staff?

Issue 9. How did planning tool technology speed the execution of the plan?

Issue 10. What percentage of the JTF was comprised of standing forces and augmentees?

Issue 11. How did the time required for assimilation of augmentees affect the JTF's ability to conduct operations?

Issue 12. Beyond current doctrine, how should the JTD be organized for combat operations and for the best C2?

Issue 13. What was the capability of the JTF? What capability was required beyond current doctrine?

Issue 14. How does the JTF best conduct rapid decisive operations? (Were enemy's coastal defense centers of gravity identified/attacked?)

3.3 EO5 – COMMON RELEVANT OPERATIONAL PICTURE

Hypothesis: IF we have a common relevant operational picture in readily understandable, scalable, filterable, and interactive format, THEN we can compress the decision cycle, react more quickly to high-tempo operational requirements, and limit risk.

Issue 1. Did the CROP enable improved synchronization of Joint operations?

Issue 2. Is the information in the CROP accurate/secured/assured and available in the time required by the user?

Issue 4. Did the CROP enable rapid, highly informed decisions?

Issue 5. How should information be presented to the commanders in order to provide them with the greatest degree of battlespace awareness possible while also focusing them on those critical areas that require their immediate attention and action?

Issue 6. How will confidence or the estimated degree of accuracy be represented in the CROP?

Issue 7. How will the conflicting information be adjudicated?

Issue 8. How will near-real-time information on the adversary and the environment be fused with baseline information from interactive databases and with own friendly force information?

Issue 9. Is GCCS being used to generate a common picture?

4.0 ATTACK OPERATIONS AGAINST CRITICAL MOBILE TARGETS

There is not a one-to-one correspondence between Joint Experimentation objectives and Fleet Battle Experiment initiatives. The overlap is considerable, but a given objective will have correspondence to more than one initiative, and vice versa. Thus, there is some arbitrariness as to how the FBE results are correlated with Joint Experimentation concerns. In the first three results sections we describe which Joint Experimentation initiatives are addressed then present the pertinent Foxtrot results. Each of the Foxtrot results sections contains a code showing the Joint Experimentation initiatives which they address, directly or indirectly. An example of a code is EO3-1,4. This means Joint Experimentation Objective 3, initiatives 1 and 4. In an appendix there is a matrix which shows the FBE-F to Joint Experimentation correspondence for the full report.

4.1 RELATIONSHIP TO TIME CRITICAL TARGETS

Essentially, critical mobile targets are a subset of time-critical targets. Out of this very broad topic, FBE-F focused on using a centralized process, a Joint Fires Element (JFE), to manage the time-critical targets process. Thus, the results presented here are appropriate mainly to this centralized process. The immediate following is a description of the JFE process.

FBE Foxtrot was based largely on a principle of centralized processing to support concurrent and in-stride operations by joint warfare commanders and their specific forces. A Joint Strike and Joint Fires Element were central components of this structure and a demonstration of a set of *capabilities* necessary to the conduct of Joint Maritime Access and Control.

Capabilities in this portion of FBE-F were hierarchical. These capabilities could be decomposed into a capability to conduct deliberate planning in support of an Integrated Tasking Order (ITO) by coordinating a Joint Forces Air Component Commander (JFACC) with component requirements (USN, USA, USAF) and Joint Warfare Commanders such as the Joint Forces Maritime Component Commander (JFMCC) and the Joint Forces Land Component Commander (JFLCC), each of which had their own internal processing capability to define their deliberate targeting needs. At a similar level, a capability to conduct specific targeting missions against Time Critical Targets required a separate capability, but one highly coupled to the "processing engine" of deliberate strike.

Specific Joint Fires initiatives are stated in the FBE F Experiment Plan. A portion of these include:

- Define system and organization requirements for conduct of Time Critical Targeting.
- Explore capability of Enhanced TLAM operations.
- Explore use of Army Tactical Missile System (ATACMS) to support JMAC and Joint Fires.
- Examine construction and implementation of a Digital Fires Network in the Arabian Gulf (AG).

Additional initiatives that were specific for the Joint Fires Element:

- Define requirements that enable a Joint Fires Element to work directly for the JTF, emphasizing Naval Surface Fires Support (NSFS) to prosecute deliberate (ITO) strike and TCT's.
- Produce aimpoints of requisite quality for JFE prosecution from sensor events.
- Determine system and processing requirements to localize, identify and prosecute TCT's.
- Explore requirements for establishing a Joint Fires Network as part of the Digital Fires Network.
- Improve capabilities to coordinate and synchronize TCT and deliberate targeting processes between the JFE and the Joint Strike cell.
- Experiment with simulations of future weapons systems and munitions by providing excursions within the battle problem.

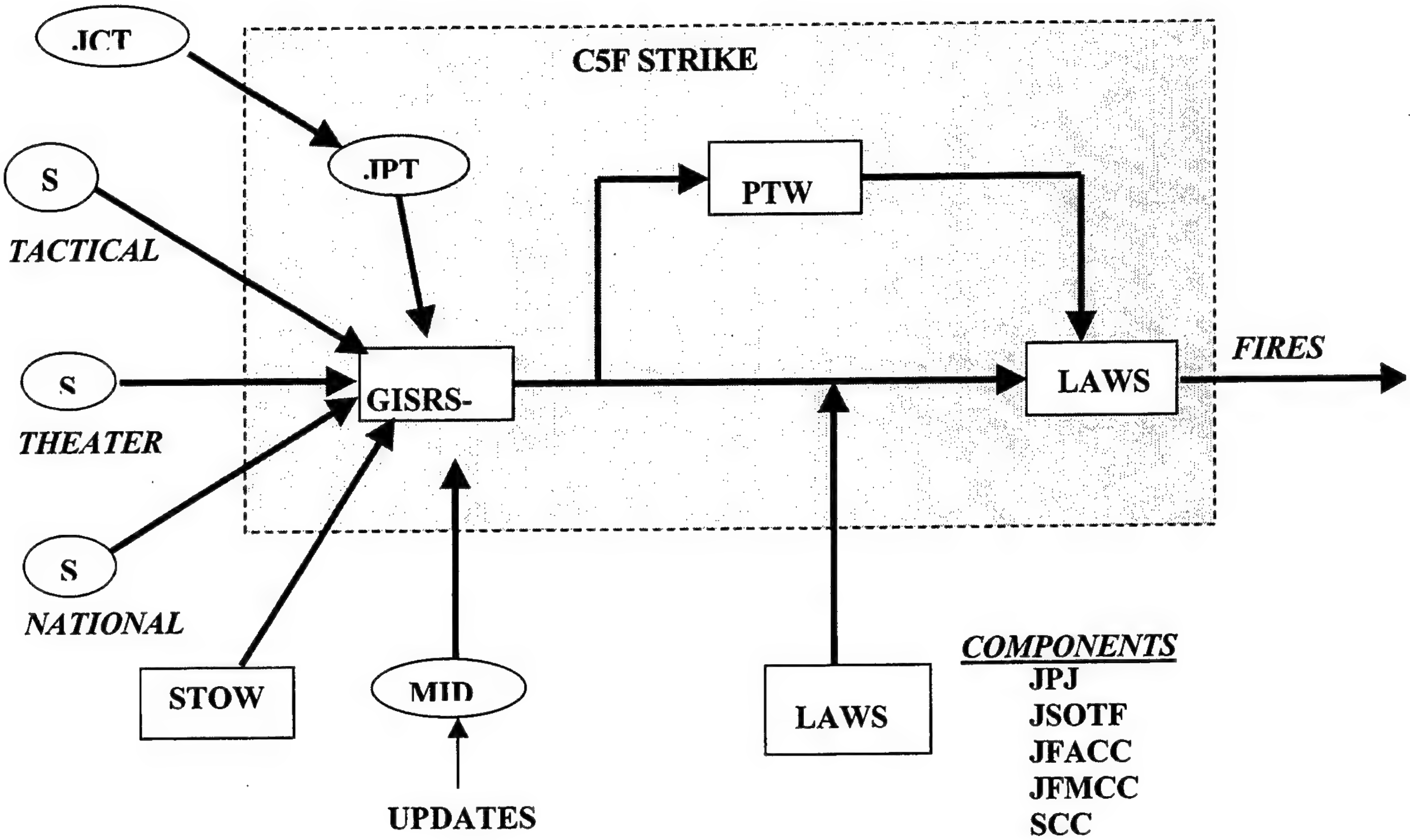
Assumptions made in execution of operations were that information would be resident in theater and not available through reachback (with exception of MIW *change detect* experiment), that real theater sensors and weapons (2005) would be used, and that many of the events would be simulation driven.

The following were specific JFE questions of interest:

- Did the JFE perform TCT sensing, target pairing and mission assessment within the TCT "dwell time?"
- Did the JFE concept enhance performance of parallel operations necessary to Joint Maritime Access Control?
- Does JFE enhance concurrent ASW and MIW operations, as well as multi-mission tasking (e.g., organic ASW/MIW)?
- How does a JFE organization impact coordination of Joint Assets for maritime operations?
- What results are indicated between the deliberate ITO planning processes and conduct of dynamic TCT missions?
- Is the JFE organizationally sensitive to system conflict and degradation? Is the JFE capable of self-organization in a time-sensitive environment?
- Was requisite information available to decision makers at LAWS to make timely and reasonable decisions?
- What impact did GISRS-M have on the sensor management related to reduction in TCT decision making time?
- How was information made available to higher authority as required?
- What feedback mechanisms were employed throughout the JFE system?
- Were changes to the TLAM process (MDS 4.X) useful in improving TLAM responsiveness?

4.1.1 Joint Fires Element System Description

The following are short component descriptions with regard to how data were collected, processed and distributed within the JFE (Operations) system. The figure provides a simplified block diagram of the key JFE components:



Sensor Grid: combined tactical (UAV, TARPS CD, LANTIRN, AIP P-3, SOF, SIGINT), theater (e.g., U-2 EO/SAR, RC-135 SIGINT and AWACS) and national (TENCAP) sensor inputs to GISRS-M. These feeds included imagery files of varying resolution and size.

FBE-Foxtrot tested centralized management of sensors and sensor information. Sensors are a crucial component in the effort to rapidly prosecute time critical targets, and to achieve and maintain situational awareness. Success may depend on having coordinated management of organic sensors and of the information from organic and inorganic sensors, and tactical input to inorganic sensor management.

This portion of the experiment was designed to test tactical sensor capabilities, centralized management of those sensors, fusing information from tactical sensors and national assets, rapid information processing, distributing results for fires decisions, and ensuring assessment of fires decisions for conformity with commander's intent. Central to the approach is the visibility of ISR to Operations and the ability to accomplish dynamic ISR change based on operations execution.

FBE-F tested an ISR anchor desk within a Joint Fires Effects Cell, received information from tactical and national sensors, and passed target information to a fires decision system in the Fires Cell. The ISR Desk was supported by the GISRS-M system. Fires decisions were supported by PTW+ for developing target coordinates and LAWS for weapon-target pairing. These three systems were components of the "sensor grid", "information grid", and "decision grid", respectively. The tactical sensors used were TARPS-CD, P-3 sensor suite, and simulated UAV.

- GISRS-M; where a sensed event was noted and became a nominated target, or "target-nom." This was both a technological and a human interaction with sensor feeds. Three ISR desks were manned. Operators at each desk made decisions to name any potential sensed event as a target nomination. This data was conveyed over the Global Intelligence, Surveillance and Reconnaissance (Maritime) system (GISRS-M) constructed as a sub-initiative for this experiment.
- Modernized Intelligence Data-Base (MIDB) provided a portion of electronic comparison for nomination processes and for target mensuration.
- Target Prioritization List contributed the results of an effects-based targeting process in the Effects Coordination Board (ECB) to the ISR desks.
- Attack Guidance Matrix defined system Target Location Error (TLE) requirements for nominated targets prior to being paired with a weapon system in LAWS.
- Precision Targeting Workstation (PTW+) was the point at which mensuration of nominated targets (TCT's) was conducted. Nominated targets were compared to MIDB and Attack Guidance Matrix for determination of target image and aimpoint quality prior to being pushed to LAWS. If the nomination did not meet system requirements an operator would then use PTW+ tools to make comparisons to the various C5F and Strike Intelligence libraries for further imagery support. The product of this effort was a mensurated target with aimpoint quality that could be used in pairing a weapon system to the nominated target in LAWS.
- Land Attack Warfare System (LAWS) performed final weapon to target pairing (WTP) of mensurated or otherwise validated nominated targets. At this point the nominated targets were considered to be targets for fire missions. LAWS output produced a WTP, fire mission and inventory of weapons as they were used (engagement grid).
- Joint Continuous Strike Environment (JCSE), an ACTD (?) was provided similar information as LAWS, in a parallel feed. The output of JCSE was not used for further system processing (i.e., no fire missions were produced from JCSE processing).

<u>JFE System Inputs:</u>

- Synthetic Theater of War (STOW) provided simulated targets, weapon systems, sensor inputs of sensed targets, and force movements (geo-translation of potential conflict areas, MIW and ASW operations areas) to GISRS-M (and then to LAWS). (Did GCCS-M play any role here?).
- Integrated Tasking Order (ITO); was produced through a long-range planning process and fed into LAWS after JFMCC, JFACC review.
- Effects Management process produced the Target Prioritization list described above, as part of the ITO planning process.

4.2 JOINT EXPERIMENTATION ISSUES ADDRESSED BY FBE-F

Each issue is repeated here in italics, followed by a description of why they are addressed or not. Again, note that the experiment did not deal directly with these issues. The results that are presented are those which are pertinent to the issues.

Issue 1. *What degree of confidence is required (or acceptable) by a JFC to automatically identify and attack critical mobile targets?* The experiment did not test this issue. It focused on the activities within the JFE.

Issue 2. *What is the most appropriate C2 structure to satisfy the time restrictions posed by attacking critical mobile targets?* This experiment focused on a centralized C2 structure. The results here address that structure. Conclusions about which structure is most appropriate will need to be developed by comparison of results from more than one experiment.

Issue 4. *Will the interaction of future sensors and sensor exploitation technologies, future command and control technologies, and future weapon systems contribute to an effective attack operations system?* The experiment addresses several aspects of this issue. The JFE utilized an ISR desk for sensor management. The experiment tested the utility of that desk. Results were obtained on sensor configuration and sensor information.

Issue 5. *Can systems be designed to provide dynamic tasking and re-tasking of rapid, long-range, accurate and flexible air, land, and sea engagement systems?* The experiment tested tasking and re-tasking of sensors. Several results on sensor management are presented.

4.3 RESULTS

All results presented in this section and the sections that follow have the following format:

Type of results by title
Joint Experimentation Objectives and Issues they address
Detailed content of the results

This means that a given set of results can apply to more than one Objective or Issue, e.g. a result on sensor management could apply to both Attack Operations Against Critical Mobile Targets and Common Relevant Operating Picture, would appear in only one of them, but have reference to the other. In this way it is easy to correlate results and issues without having to present the same results several times.

4.3.1 Time Critical Targeting Processing:

A parallel, distributed processing system was envisioned (Appendix B, FBE Foxtrot EXPLAN, C.3.10.3 and C. APP 3. TAB A).

4.3.1.1 Configuration Issues

EO1-2, 3, 4, 5

Three ISR stations were planned to receive all of the ISR sources (including live and simulated). Processing system performance depended upon the capability of the system to receive sensor

inputs and add them to the comparisons performed at the next level of the system by LAWS and PTW+. An optimal ratio of system components to sensor feed in this integrated systems architecture should limit queuing conflicts so that no TCT is left unserviced due to "bunching up" of target nominations.

Originally three (3) PTW+ units were to be part of the JFE, however only one was employed in the experiment. The result was a backlog of sensor target nominations at PTW+.

Analysis of optimal technology mix should be the focus of additional experimentation. In general, in the context of this experiment it seems that the required ratio for system performance within TCT dwell times should have been on the order of one ISR desk forwarding target nominations to one PTW+. This one to one relationship does not necessarily imply the same ratio with respect to LAWS.

Queuing of sensor feeds at ISR desks is ambiguous from experiment data. This relationship will depend upon the numbers and type of sensors, target distribution and type per unit area and C3 organization supporting sensor management.

4.3.1.2 TCT Processing Issues Related to JFE System Components

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2

- Imagery-based targeting from tactical reconnaissance assets (TARPS-CD, LANTIRN, TARPS-DI, P-3 AIP) requires a standardized imagery format.
- Imagery resolution is a critical variable to system performance. Resolution which does not meet system parameters (in this case the Attack Guidance Matrix) required for direct weapon target pairing in LAWS (or JCSE) requires further processing by PTW+. Nearly refined images require less processing here than those needing extensive mensuration.
- PTW+ can reduce mensuration timelines. However, in addition to low imagery resolution, timelines may be adversely impacted by low correlation to Intelligence Products Library (IPL) data, or by limited access to IPL. Limited access is typically related to inadequate data storage immediately accessible to the PTW+ operator.
- Related to the comment above, the Modernized Integrated Database (MIDB) may not contain necessary data to construct TCT aimpoints. At issue here are the variable rates at which the MIDB may be refreshed at different locations.
- LAWS specific processing issues:

  Capabilities related to messaging include a requirement for the operator to keep the "incoming log" open at all times for added situational awareness, and to maintain the display of a broadcast message while also activating other windows.

  A protocol needs to be developed so that multiple LAWS nodes can provide mensurated target information for further processing in PTW+. In this FBE there was ambiguity when one

  LAWS unit (e.g., aboard the CV) would need to push a target nomination to the LAWS station in the JFE.

  There were instances in which BDA reported over GSIRS-M were designated as random

  Targets in LAWS: There needs to be a distinction between BDA reports and potential targets, which should also include a means to couple the BDA to a specific LAWS target.

4.3.1.3 *Summary of TLAM Enhancements and Impact*

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2

LAWS was modified to support in FBE-F the management of TLAM engagements. The principal characteristics of that capability include the following:

1. TLAM Mission Manager. The Mission Coordination: TLAM list displays, in a single line for each mission, the status of all TLAM, TTLAM and LASM missions prosecuted, or in the process of prosecution, by all platforms. Double clicking a mission in this display provided the detailed mission data. Using the add function the LAWS operator can enter the data for creation of a new mission in the TLAM Mission manager. A mission can also be created in LAWS by importing an Indigo or LSP message

2. TLAM routes. A request for a TLAM route is automatically generated and transmitted to the LPMP with the Mission Planning request tool. LAWS accepts and stores the returned route information.

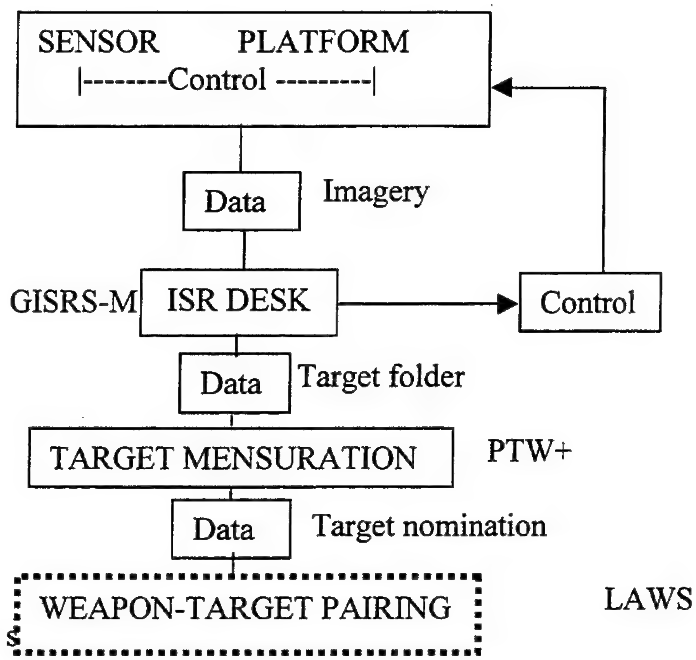
3. Fire Commands. LAWS can generate an Indigo message.

4. Inventory Status. The weapons inventory menu provided several ways of looking at the weapons inventory of all the platforms in the experiment. In particular, the Ships option in the weapons inventory menu provides a pictorial display of the status of each VLS cell on a platform.

5. Inventory Update. LAWS, on receipt of a TIR or Indigo Firing Report message automatically updated VLS cell inventories.

4.3.2 Sensor Management in the JFE Process

The following figure shows the components of what we refer to as the "sensor system", (or "sensor grid") which includes sensors, sensor information, sensor management, and fused sensor information. LAWS, which is outside of this system is also shown because it is the recipient of target nomination data. Reference can be made to the JFE cell diagram to see the position of this system within the JFE. We do not show all of the individual components of the sensor system, rather agglomerate into function blocks for efficiency of results presentation.



A sensor is mounted on a platform. The platform "pilot" may be able to Control the sensor.

Data sent from the platform can Contain status communications.

ISR desk control of sensors is via a platform controller

LAWS is not part of the

Principal Sensor System Results

These principal results are syntheses of the system component results that follow. They refer to performance of the system within the JFE rather than performance of system components. They are divided into areas of interest.

4.3.2.1 JFE Sensing of Targets within the TCT's Dwell Time

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2, 3, 4, 8

The ISR anchor desk provided an important new capability for local collection management, making it possible to deal with TCTs more expeditiously. The Attack Guidance Matrix (AGM) was a useful tool but it needs to be modified to make it a collection management and execution aid. The desk allowed parallel sensor, target location and identification, and weapon target-pairing processes. The result of having the JFE as an overarching capability was a more rapid process than is normally obtained by sending less processed information to component commanders.

The JFE concept improves dynamic response to emerging threats, such as TCTs, through centralized management of assets. The time scales of information available to this function need to be modified to match the pace of its operation. Examples are a dynamic target list rather than an AGM, an ITO and Modernized Information Data Base (MIDB) that are refreshed in time-step response with the tactical situation.

The JFE needs a complete tactical picture in order to perform its function. This may be beyond what would normally be provided by a COP. For example, JFE needs projected tracks of sensors. It also needs cradle-to-grave information about threats, including those which haven't been adequately mensurated nor designated as targets, and the results of BDA.

Doctrinal changes, such as the inclusion of the J2 and J3 watches in the JFE and improved interoperability should be explored. This would allow real-time fusion with sensor information. Real-world operations precluded the assignment of the intelligence staff for Foxtrot. Possibly as a result, responsibility for collection planning was not clear.

4.3.2.2 JFE Coordination of Joint Assets, Interactions with ITO planning and dynamic TCT

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2, 3, 4, 8

Because it can be a focal point, considerable attention to ISR desk manning, responsibilities, TTPs, etc. are needed. A possible methodology is a sensor plan developed in parallel with the ITO followed by ISR desk managing by exception.

TTPs are needed for sensor control that is responsive to the dynamic tactical situation. It is unclear how control of sensors should change in a self-synchronized manner as tactical requirements change. Note that in Global-99 control/management of ISR was relocated twice during the course of the game.

The ISR desk needs to treat tactical sensors as organic assets. In order to do this it needs access to the same platform information that is available to the JFACC and needs real-time coordination of those platform's assignments. Two-way communication between the UAV sensor controller and the ISR desk reduced the nomination time-lines, implying an increase in efficiency of TCT prosecution.

Easy to use, real-time communications are needed for the JFE to perform its function. As examples: Efficient communication paths (verbal, e-mail) between the ISR desk and the mensuration operators was an essential part of the process. Voice over IP was an effective method to communicate with UAV operators and vector UAVs to areas of concern.

Additional doctrinal development is needed to identify the reinforcing roles of all search and prosecution participants.

UAV pictures and location data aided targeting but command relationships and control doctrine need to be defined.

4.3.2.3 ISR Desk Management, Processes, and the TCT prosecution time

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2, 3, 4, 8

The ISR desk appears to decrease the time-line for that portion of the system from sensor to target nominations. For example, interaction between the ISR anchor desk and UAV control enabled tactical control of the sensor grid within a 10-min threshold (from LAWS data and interviews).

Experience gained during Foxtrot operations allowed the GISRS-M operators to build target information folders that could be more efficiently mensurated.

There were bottlenecks at various points in the process, e.g. GISRS transmission via smtp taking 30sec to 10min or three GISRS workstations overwhelming the PTW+ station. This indicates that extending this configuration to handle a full tactical area will require careful examination of

information loads at the choke points. Balancing the number of GISRS-M, PTW+, and LAWS terminals and improving their interoperability is required to eliminate bottlenecks especially if the sensor/information process becomes more efficient.

As an ISR desk becomes overloaded, areas of sensor exploitation could be cued in communications between the ISR desk and remote exploitation sites.

Passing of target images from F-14 TARPS-CD pods to GISRS-M is a promising innovation for finding targets. This process was severely handicapped by poor experiment connectivity (does not diminish potential capability).

4.3.2.4 *Quality of Sensor Information*

EO1-3 EO3-2 EO5-2

The full system does not provide sufficient information to do an adequate assessment of TLE, which is necessary for improved targeting. This degree of centralized processing requires more information about the sensors and platforms than is normally provided. Real-time telemetry of this information needs to be provided with imagery. Fusing sensor data can require inclusion of this information.

"None of the sensors provided a TLE adequate within the ROE to shoot on. They all had to go through the PTW+ for precision targeting. This resulted in a stovepipe process—a serial one if the target was coming from sensors." (GISRS-M lead)

Target mensuration is greatly aided by multiple resolution imaging. However, passing full images for all possible targets overloads the system. A decision process is needed that restricts the amounts of information passed to the fires cell. Several actions could aid this situation:

- Pass hyperlink references to images rather than the images.
- Resolve ambiguity and duplication at the ISR desk before passing nominations.
- Use the Attack Guidance Matrix and forward nominations based on priority.

None of the sensors provided a targeting quality TLE, which required all imagery to go through mensuration before weapon assignment. To a large extent this was the result of simulation. Simulated images were pre-built in the STOW and injected into the JFE decision process later. These digital target images were of lower quality than would be expected from "live" images from "real" systems. Lining each image into a mensuration processing queue resulted in a highly serialized process, with possible bottlenecking and a slowdown of the TCT process. Improved information from the STOW sensors could result in an improved process by which some targets are of sufficient targeting quality to bypass portions of the mensuration process, resulting in more rapid prosecution of TCTs.

4.3.2.5 *Sensor and Platform Capabilities*

EO1-2, 3, 4, 5 EO3-2, 3, 7 EO5-2, 3, 4, 8

In FBE Echo near real time information was combined from JSTARS, UAV, Links 11 and 16, and LAWS. Fusion and an enhanced capability to conduct Full Dimension Protection as a result illustrated the power of Network Centric Operations (NCO). FBE Foxtrot furthered understanding of this capability however, there are also doctrinal and semantic deficiencies.

Sensor managers on platforms and UAV controllers need to observe sensor output in order to obtain quality information. They also need to be in communication with the ISR desk so that real-time coordination between sensor data and information requirements can be accomplished.

Mobile targets require additional sensors including an organic MTI/SAR capability.

Attention is needed with regard to image type, quality, and an accompanying information package that are required for this system to efficiently nominate targets. For example, P-3 imagery needs to have longer dwell times in order to be useful. Passing images through a chain of workstations for processing can degrade them to the point where mensuration is not possible

Need an airborne sensor with higher resolution for increased stand-off capability.

Mobile targets require additional sensors, including organic MTI/SAR capability.

Sensors for the asymmetric threats such as swimmers, jet skis, and rubber boats have not yet been developed beyond the human eye and ear, each of which is limited by darkness, high winds and waves, etc. The Air Force C130U has special capabilities for detection of humans that could potentially be added to the network. Further doctrinal development and connectivity is required.

4.3.2.6 System Component Results

The following results refer to specific components of the sensor system. They are:

- Sensor Information
- Sensor Control by the Platform
- Sensor Data (both data content and transmission pipeline)
- ISR Desk
- ISR Desk Control of Sensors
- Target Folder Data (both data content and transmission pipeline)
- Target Mensuration
- Target Nomination Data (both data content and transmission pipeline)

In addition to results that apply to specific system components there are results that refer to supporting information. They are:

- GISRS-M Supporting Reference Material
- PTW+ Supporting Reference Material
- COP Issues

4.3.2.7 Sensor Information

EO1-3 EO5-4

TARPS-CD specific results:

- System performed well, with some shortfalls.
- Additional rapid tactical reconnaissance is needed. TARPS can provide tactically important time critical information on initial strike Bomb Impact Analysis and on movement of forces.

- Include EO, IR, and Radar in the TARPS pod. TARPS-CD contains only one sensor whereas the wet film version contains 3.
- Need increased resolution for higher over-flight and an increase in stand-off distances.
- Enhanced capability of sensors should include reliable automatic target recognition.
- Important characteristics to incorporate as capabilities:
  Ability for pilot to remain heads-out
  Feedback for camera operation
  Reliable operation during tactical maneuvering
  Ability to reset the camera after transient faults
- Significant capability improvements are:
  Increased coverage of the CD version
  Earth stabilization
  Sensor maintains performance during dynamic maneuvers
  Feedback of camera operation and image capture to the operator
- Specific recommendations to improve TARPS-CD capabilities are:
  1. Allow the capability to exchange the CD-261 for an IR or combined EO/IR camera for night reconnaissance.
  2. Investigate multiple sensors by replacing the forward TV camera with a better sensor for imagery collection.
  3. Provide a better antenna (perhaps directional) and improve the location for better range and reliability.
  4. Decrease the delay between turning on the camera and image capture.
  5. Allow more operator adjustment for exposure.
  6. Provide the software for a file of imagery history for graphical depiction (preferably for use with PFPS).
  7. Incorporate a solid state recorder system.
  8. Increase memory for thumbnail analysis on the waterfall display.
  9. Provide software for stitching of thumbnails.
  10. Provide software for annotating images.
  11. Provide training for base station users and a technical representative for troubleshooting.
  12. Provide a technical representative for camera maintenance.

4.3.2.8 Sensor Control by the Platform

EO1-3 EO5-4

Exposure adjustment should be made from imagery seen in the cockpit rather than terrain type, and a wide range of shutter speeds rather than a single stop adjustment would be an improvement.

The platform pilot needs a heads-up sensor display to enable controlling sensors while executing flight maneuvers.

4.3.2.9 Sensor Data

EO1-3 EO5-4

TARPS-CD wideband data link inoperative, data conveyed by physical transfer of digital tape.

High quality TARPS-CD data received at C5F. >1 hour latency due to data recovery, image screening on JFK (NAVIS ground station) and SIPRNET transmission.
UAVs/P-3/TARPS must provide telemetry data stream (coordinate, TLE)

Tactical imagery needs to include a North arrow and exploitation support data.

Need better location for the omni-directional antenna for F-14 TARPS. A directional antenna in the nose could be used for long distance transmission.

Provide a graphical depiction of the aircraft flight path on the imagery as a photo interpretation aid.

The Common Data Link connectivity, as a self-contained, real-time imagery system does not meet expectations. Burst transmission of thumbnails through other established links could provide some capability up to 300 miles.

Next generation sensor telemetry could include sensor pointing and location accuracy to yield target location error.

Target Location Error is necessary for TCT, thus the ISR anchor desk must have the capability to compute it from sensor data.

Target location error must be included in real-time video sources.

F-14 LANTIRN acquired and imaged live targets and disseminated via FTI. In every case, received images at ISR were of too low quality for target ID.

P-3 video provided sufficient resolution for target recognition.

P-3 video could not be used for TCT nomination because of dwell/direction and location. 15-30 sec of stabilized video needed for PTW+ mensuration, on the average only about 5 sec was available.

P-3 video contained no telemetry nor location info to provide even rough localization of targets.

Send the imagery to other strike or C2 aircraft. Would need to include the N arrow, coordinate, and a distance scale.
Send a continuous stream of images to intelligence centers to analyze real time.

Use JSTARS GMTI information as a means of cueing the TCT process. Fusion is a problem. Passing GMTI data as tracks followed by SAR NITF images could eliminate this problem.

4.3.2.10 *ISR Desk*

EO1-2, 3 **EO3-7, 12, 13** **EO5-4, 8**

Need automatic, continually displayed, target quality in GISRS.

GISRS should bundle multiple target view images.

Bundled images: permit the operator to choose the best image for targeting.

Need reverse playback capability for photo interpretation.

One operator can simultaneously monitor two streams of streaming video, but can only work a single feed for nominating TCTs.

Locate an 8x8 video switch with the ISR anchor lead for expeditious changes from sensor-to-sensor and workstation-to-workstation.

Real-time ISR assets resolved uncorrelated ELINT contacts through a display-centric fusion process. The Attack Guidance Matrix was used to fly UAVs to TCT/ high payoff activity areas in response to uncorrelated contact reports, resulting in a large number of successful cross-cued TCT prosecutions.

A TTP is needed for direct coordination with reachback exploitation sites.

Direct, automatic distribution of newly collected imagery from framing sensors to ISR situational awareness displays is a proven concept for TCT ISR support.

Proven concept for TCT ISR support: Direct parsing and display of footprints associated with newly collected imagery from framing sensors to ISR situational awareness displays works. NITF images with 4-corner coordinates were parsed and an icon displayed the latest collection event on the ISR Situational Awareness display.

ISR sensors can capture multiple targets on a single frame or chip. Need a way to connect individual aimpoints with the original TCT nomination and tracking from cradle to grave.

Summary of functional requirements/capabilities used/identified for the ISR anchor desk to support the TCT process:

1. Directed exploitation/analysis support:
   Capability for designating and automatically disseminating ISR TCT nominations to ISR analysis nodes for additional time critical exploitation/analysis support.

2. TCT target nomination interface providing the capability for nominating targets directly from each of the following data/information sources:
   Video
   COP
   Voice reports

MIDB/reference data (cued by other sources)
NRT SIGINT
GMTI

3. Attack Guidance Matrix/Sensor tie-up table.

4. Dynamic Target List/LAWS mission status tracking panel

5. Real-time collection steering support

6. ISR rout plan formulation/display/monitoring

7. On-line MIDB data query is based on geographic coordinates of the ISR situation awareness window.

4.3.2.11 ISR Desk Control of Sensors

EO1-2, 3 EO3-7, 12, 13 EO5-4, 8

Need ability to talk to the aircraft sensor operator

ISR management needs to cue/direct time sensitive exploitation of tactical imagery when bandwidth precludes forwarding raw imagery.

Need coms so TCT ISR can cue areas of exploitation emphasis at decentralized exploitation nodes. (a TTP)

Two-way coms between with the UAV sensor controller resulted in decreasing the time to nominate TCTs and increased the number identified and prosecuted.

ISR anchor needs for control of the sensors for TCT

- Sensor telemetry must include position and pointing.
- Need the same information as a ground control station.
- tactical control of real-time sensing from UAVs should be a TTP
- Can provide warning to pilots of potential danger with respect to target sites.

Sensor TTPs cannot be generalized but must be specifically tailored to the capabilities of individual sensor platforms.

Voice Comms are a tremendous facilitator for TCT when sensor control and TCT cell are not co-located. IVOX adequate at times, infuriating at others. Collaborative Virtual Workspace during JEFX was considerably more reliable and useful.

4.3.2.12 *Target Folder Data*

EO1-3 EO3-2, 3, 4, 7 EO5-2

Target nomination package transmission too slow, now 2-10min.

Moderate to poor quality/resolution imagery data: GISRS digitization, then frame grabbing, then bitmapping, can render imagery unusable.

Reference imagery included with target nominations from GISRS to PTW+ is a necessary component and needs improvement.

GISRS to PTW+ nominations sometimes included multiple aimpoints.

It would be better to disseminate hyperlink references to an image rather than the images.

GISRS transmitted to 4 different smtp mail hosts, with a wait time of 30 sec to 10 min. This bogged down the nomination process.

ATI.ATR target nomination needs to handle multiple coordinates and multiple pictures, a folder.

4.3.2.13 *Target Mensuration*

EO1-3 EO3-2, 3, 4, 7 EO5-2

Precision mensuration not accomplished in near-real-time at C5F due to operator and workstation workload conflicts, and due to integration difficulties with the TIGER software application on the JTW.

PTW+ was not fed with national imagery. Necessitating estimation of target location.

More PTWs needed for this size operation.

Need a quality double-check on the mensuration process.

Single PTW+ client workstation insufficient for a targeting cell. Nominations from 3 GISRS workstations overwhelms it.

TCT nominations should remain local until ambiguity is resolved and check with other nodes for duplicate nominations

Visual Target Aids attached to ATLARs: were of extremely poor quality, occasionally missing (thus no mensuration possible), and must be annotated to eliminate errors.

4.3.2.14 *Target Nomination Data*

EO1-3 EO3-2, 3, 4, 7 EO5-2

LAWS and other operational systems need to be able to process and retrieve ISR analyst narrative comments.

Manual typing of ATLARs produces errors, and transmission via Eudora e-mail resulted in 2-3 increase in transmission time. Need self-populating interface.

4.3.2.15 GISRS-M Supporting Reference Material

EO1-3 EO3-2, 3, 4, 7 EO5-2

Collection Manager should link to ITO to determine green status for collection plan.

Need a Sensor Guidance Matrix providing ROE for matching ISR info to a TCT.

Collection Management Planning Template was needed for the host command.
Tracks vs Targets: Use the Attack Guidance Matrix for screening TCT nominations to reduce overload of the operations system.

4.3.2.16 PTW+ Supporting Reference Material

EO1-3 EO3-2, 3, 4, 7 EO5-2

Classify targets according to the location accuracy needed for the weapon type to be used against them.

Digital Point Precision Database (DPPDB) and NTM need to be collected and loaded on PTW+. DPPDB age and image resolution were significant detractors from PTW+ performance.

NTM imagery to PTW+ must be in primary formats, not IDEX exploited and without full exploitation support data.

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5.0 RAPID DECISIVE OPERATIONS

5.1 RELATIONSHIP TO SUPRESSION OF ENEMY COASTAL DEFENCES

In this Joint Experimentation context, Rapid Decisive Operations refers to using highly mobile forces for land attack. The basic concept is that, if highly effective force can be applied surgically, and if there is timely, accurate information for monitoring and making rapid decisions, victory can be achieved with minimal damage. FBE-F dealt with naval forces clearing a littoral area. It was a test of naval capabilities to support access. Access is a critical part of naval support of the land battle. Thus, the coastal access experimentation in FBE-F is a direct test of a portion of Rapid Decisive operations. Also, the main purpose of access experimentation was to develop methods for reducing the timeline, a direct concern of Rapid Decisive Operations.

There were no land forces played in FBE-F, and no strike against high priority targets other than that needed to suppress coastal defenses. Thus, the FBE-F results appropriate to this Joint Experimentation Objective are Anti-Submarine Warfare (ASW), Mine Warfare (MIW), and those results which have been presented above for Time Critical Targets. The concept tested for ASW/MIW was parallel operations, using organic assets, to rapidly gain access to the littoral area.

5.2 ISSUES ADDRESSED BY FBE-F

Issue 1. *What are the information requirements available to the JFC?* Question not understood in this context.

Issue 2. *What are the information generating assets available to the JFC?* Results were obtained for sensors, processing of sensor information, and reference databases.

Issue 3. *How is the information for the JTF managed, coordinated, and distributed?* Information management results were obtained for a centralized Joint Fires Element and an Effects Coordination Board.

Issue 4. *Were Critical Information Requirements (CIR) identified for the JTF?* Results were obtained for sensor management information, ocean environment information, and mine location.

Issue 5. *How quickly were CIRs passed?* No information obtained.

Issue 6. *How were the CIRs filtered so the CJTF only received info critical to decision making?* No information obtained.

Issue 7. *What planning, decision, and execution support tools were used by the JTF staff?* No results were produced for decision support tools. Various systems were used by operators to process and disseminate information and those results are included.

Issue 8. *What % of the CONPLAN was developed by planning tool technology?* No information obtained

Issue 9. *How did planning tool technology speed the execution of the plan?* Speed of planning execution was not a factor in this experiment.

Issue 10. *What percentage of the JTF was comprised of standing forces and augmentees?* No information obtained.

Issue 11. *How did the time required for assimilation of augmentees affect the JTF's ability to conduct operations?* No information obtained.

Issue 12. *Beyond current doctrine, how should the JTD be organized for combat operations and for the best C2?* The results obtained are for a centralized management configuration. The performance of that configuration is evaluated but no recommendations for best C2 configuration are made.

Issue 13. *What was the capability of the JTF? What capability was required beyond current doctrine?* Needed capabilities for Effects Based Operations are addressed in that section.

Issue 14. *How does the JTF best conduct rapid decisive operations? (Were enemy's coastal defense centers of gravity identified/attacked?)* Attacks were against coastal targets of immediate interest to gain access rather than centers of gravity.

5.3 FBE-F MINE WARFARE

In order to assist the JFMCC and MIWC in executing their mission, FBE-F attempted to highlight the effect of future capabilities and gain some insight into a mix makeup of organic and dedicated MCM forces in the 2005 timeframe. The foundation of the experiment was the tactical data link exchange between experimental mine countermeasures tactical systems (mainly through simulations), legacy mine countermeasures systems, and a command and control network to tie the two together. The need for a high degree of situational awareness for units operating in a dynamic environment makes this a necessary requirement. Through networking, display and management systems the following operational capabilities were evaluated:

- Tactical data link capabilities to support timely exchange of MCM tactical information between the on-scene tactical commanders and assigned MCM forces.
- Automated MCM planning, evaluation and execution decisions support tools and automated information management and reporting capabilities interfaced with host platform core C4ISR capabilities.
- Automated capabilities to develop, maintain and display a common MCM tactical picture, with the capability to integrate it with the rest of the maritime picture into the CJTF display. The MCM picture includes mine and mine-like contact locations, mine threat and danger areas, gaps in potentially mined areas, Q-routes, breakthrough and clearance status, and the location and status of MCM forces.

5.3.1 MIW Questions of Interest

Organizational

- How did the JFMCC/SCC/MIWC interface with each other and other warfare commanders for the tactical control of platforms with organic MCM capabilities?

- How did having organic MCM capabilities affect the Battle Group Commander's response in multiple threat situations and conflicting mission requirements?

- In a multi-threat situation, was the SCC, with the MCM mission assigned, able to effectively direct MCM forces, including organic MCM assets, clearly and with no ambiguity as to intent?

- To what extent did Warfare Commanders cooperate with the MIWC to support MIW mission when conflicting mission tasking requirements were present?

Architecture

- Do automated MCM planning, evaluation, and execution decision support tools provided sufficient support for Distributed Collaborative Planning (DCP) for the MIWC?

- Was the MEDAL/GCCS-M connectivity sufficiently robust to provide a near real-time Common Tactical Picture (CTP) between the MCM units and the SCC/JFMCC?

- Did the CTP provide sufficient situational awareness for the SCC to make knowledgeable tactical decisions based on mine threats depicted on the shared CTP?

- Was the MCM force able to maintain communications connectivity?

- How well did an integrated LINK/GCCS-M CTP support protection of MCM assets?

Environmental

- What was the impact of having in-situ environmental data on the concurrent MIW/ASW mission?

- Was NAVOCEANO SIPRNET connectivity sufficient to support expeditious transfer of environmental and bottom topography data exchange?

- Was the NAVOCEANO reach-back and quick turn-around of real-time data into data base support products tactically useful for forward-deployed MIW/ASW units?

5.3.2 MIW Result

5.3.2.1 Parallel Operation Implications

EO1-2 EO3-13, 14

FBE-F indicates that the MCM force must be able to conduct operations in parallel within the JFMCC campaign to gain efficient control of the seas.

Unencumbered maneuver, particularly in an environment of mining in the Straits of Hormuz (SOH), cannot be achieved until the risk of mines is reduced.

Early exploration operations to find out where the mines are and where they are not is valuable input to parallel operation decision making sequence and should effect a timeline reduction in some capacity.

However, the emphasis on opening a Q-route and providing a path of communication for ships and merchants falls short of providing unencumbered maneuver in the waters surrounding the Q-route (i.e. surface ships can not conduct ASW operations from inside a Q-route).

Therefore, an aggressive assessment of the enemy's intent with regard to mining coupled with a continuous ability to assess the movement of submarines and surface ships is critical to knowing where the mines could be or equally important, where the mines are not.

In essence, for future MCM capable forces to sufficiently effect a timeline reduction, a counter-mine campaign strategy (pre-penetration phase) should be a process that begins early when indicators warrant.

It should be noted that this preliminary MIW penetration phase should also embody parallel operations. For example, submarine forces could contribute to an enhanced penetration capability by conducting concurrent organic MIW, ASW, and SOF missions during the pre-penetration phase.

Hence, it is important for the MIWC and SCC to cultivate a relationship and share relevant information at the Warfighter commander level so that each maintains the appropriate situational awareness.

An effective C^2 process between warfare commanders similar to the structure exercised during FBE-F is important for information exchange and cross-pollination of the two disciplines. Although a common operational picture should be tailored to each commanders need, in a decentralized environment, it would be beneficial during parallel operations, for the SCC to access the MIW picture and for the MIWC to access the ASW/USW picture so that each is cognizant of the complete battlespace.

5.3.2.2 Organizational Relationships

EO1-2 EO3-13, 14

FBE-F provided an opportunity for analysts to evaluate the organizational influences on the developing JMAC scenario.

Although co-locating the MIWC with the JFMCC and Sea Component Commander (SCC) on the same platform is contrary to network centric operations, centralizing the decision making process did provide opportunities to observe the interaction at various staff levels across this continuum. Close interaction between these key decision-makers was important and productive for parallel MIW/ASW operations.

However, without robust distributed collaborative planning tools, decentralizing the decision-making is a difficult task.

In the organizational structure implemented for the experiment, the MIWC was positioned to identify requirements and advise the JFMCC on the critical MIW related local battle space issues. MIW is a time consuming warfare area, especially early in the conflict. Hence, the MCM force in JMAC must be able to conduct operations in parallel with the JFMCC campaign plan to gain control of the seas. It is important that the MIWC help focus JFMCC attention to the various phases of this critical operation.

Of equal importance throughout the developing scenario was the role of the SCC, who was primarily focussed on situational analysis and providing the JFMCC with information required for ASW/USW decision making.

The organizational structure during this experiment created a dynamic that encouraged a continuous interaction between the MIWC and SCC that proved to be quite beneficial. With both working as subordinate warfare commanders to the JFMCC, the speed of command in resolving support and supporting requirements was achieved.

A common operational picture (COP) plus the effective C^2 process established between the MIWC and SCC staff's enhanced the relationship of the two organizations.

Also, situating both MIW and SCC staff watch-standers in close proximity enhanced the utility of the common situational awareness and provided an environment for dynamic information sharing.

In addition, during the experiment, it was apparent that the GCCS based MEDAL and LAWS components utilized to display the COP have the potential of offering unique warfare management tools to each warfare commander yet still provide a common situational awareness understanding required by each during parallel operations.

5.3.2.3 MIW Force Protection in the JMAC Scenario

EO3-12, 14

Force protection is fundamental to mounting an MCM campaign in parallel operations with other enemy suppression efforts.

The low density/high demand of MCM assets early in the JMAC conflict significantly raises the value of each MCM tool.

Given that unencumbered maneuver is denied to the CRUDES MCM force protection package due to the threat of mines, surveillance and armed response between the threat and the MCM asset is essential if moving vulnerable MCM forces beyond the reach of CRUDES was required during FBE-F.

Data indicates that armed helicopters (i.e. Apaches) offer such an avenue of protection for surface assets early in the conflict and essentially permit MCM exploratory operations to be undertaken throughout the Q-route area with reduced risk to the maritime asset.

Also, submarines appeared uniquely versatile and effective in supporting simultaneous ASW and MIW missions by reducing the requirement for defense against enemy surface and subsurface threats.

Cross-service sharing of force protection assets for MCM operations is a force multiplier that offers maritime assets typically tasked with this force protection role an opportunity to conduct other parallel tasking during mine sweeping efforts.

Additionally, a maturation of tactics for the employment of organic sensors will be required to optimize exploratory coverage and limit risk during this phase. After the location presence of mines is determined, maneuver area for force protection can be expanded and the reliance on armed helicopters will diminish. At that point, CRUDES assets can fully assume force protection as the Q-route is opened and MCM effort focuses on expanding the maneuver area.

5.3.2.4 Environmental Implications for MIW Operations

EO3-3 EO5-6, 8

FBE-F indicated that the primary requirement for MIW forces is an almost real-time environmental database from which tactical planning decisions can be made as well as precise sensor performance predictions for a specific unit.

The primary means of transfer and display of tactical oceanographic aids was through SIPRNET and MEDAL, and the products that were required include in-situ Bathymetric data, Bottom Characteristics Database, Surface Sediment Type database, Currents, Master Contact Database, Acoustic Imagery Mosaics, and Mine Warfare Pilot Information.

Although the experiment C4I architecture could not support the reach-back network for the MCM unit during the FBE, the effort did provide a clearer definition of the types and size requirements needed for shared databases required to support MIW. It was evident that a robust and redundant communications network architecture is essential for reach-back capability.

5.3 FBE-F ANTI-SUBMARINE WARFARE

FBE-F was used as a building block for developing a Distributed Collaborative Planning (DCP) CONOPS between the MOCC, AIP P-3, and surface ships. FBE-F explored the applications of DCP methodology to ASW search plans in support of coordinated multi-sensor ASW operations

against submarine threats in the littorals. The experiment examined methods of sharing a Common Tactical Picture (CTP) among all of the ASW forces, with the CTP including:

a common view of acoustic predictions based on high fidelity models,
databases, and
in-situ environmental measurements.

This effort was conducted in conjunction with SHAREM 131 and Arabian Mace.

During the experiment, the Sea Combat Commander (SCC) in conjunction with the ASW module performed the following:

(1) Prepared plans to conduct parallel ASW and MIW
(2) Developed a Network centric approach to ASW
(3) Developed CTP aids
(4) Conducted distributive collaborative area ASW planning
(5) Examined underwater engagement zone (UEZ)

FBE-F focused on developing a search plan methodology with the goal of developing and maintaining a force vice platform optimized search plan using DCP tools to provide the best utilization of available ASW resources to achieve campaign mission objectives. Characterization of DCP includes:

- Force vice platform level forces
- Shared operational situational awareness
- Synergistic employment of ASW force sensors
- In-situ measured and reach-back access to area environmental information
- Balanced processing and bandwidth
- Dispersed organizational structure

Exploration of CONOPS to develop and maintain a multi-sensor, coordinated ASW search plan using DCP to optimize area search under rapidly changing environmental and tactical conditions was also a primary ASW focus during the experiment.

In addition, examining the use of advanced fusion techniques, shared high fidelity models and associated environmental data bases, and networked communications to increase situational awareness of the undersea battlespace were focal points of data collection efforts.

5.4.1 ASW Questions of Interest

- Did the force optimized search plan developed via the Distributed Collaborative Planning (DCP) methodology yield a higher probability of detection (Pd) compared to the aggregated Pd of the independently developed platform search plans?

- Did the force optimized search plan developed via DCP methodology provide a greater sensor coverage for the volume of interest significantly minimizing or eliminating gaps that an adversary submarine could exploit?

- Did in-situ environmental data allow the SCC to develop and maintain a more accurate search plan (sensor lineup), and provide a greater confidence in implementation of the same plan developed with historical environmental data?

- Did the evaluation of time-series in-situ environmental data yield insight that permitted the SCC to further optimize the force integrated search plan to increase the Pd of the adversary submarine?

- Did Concurrent MIW and ASW operations reduce the time that would have been required if sequential operations had been conducted?

- Did Concurrent MIW and ASW operations subject the mine sweep assets to any higher ASW threat than sequential operations?

5.4.2 ASW Results

5.4.2.1 Parallel ASW and MIW Operations

EO1-2 EO3-4, 12, 13

Parallel ASW and MIW operations conducted to improve mission execution timelines, proved feasible compared to traditional serial operations.

During FBE-F, collocation of the SCC and MIWC was important to the development of parallel operation plans for the JFMCC. The lack of a robust and redundant communications infrastructure would have significantly impacted this relationship if the Commanders were at geographically separate locations.

The dynamic working relationship between the SCC and MIWC during FBE-F enhanced both Commanders intimate knowledge of the operations area (environment and bathymetry), and intimate knowledge of adversary submarine operations/tactics. These were significant factors in measuring the force protection requirements during parallel operations planning.

It is important to mention that accounting and planning for the priority of SCC and MIWC force protection requirements at the JTF level is critical to the success of parallel operations are to become feasible. Without the appropriate priority, operations will default to serial.

Netted sensor effects that allow the SCC and MIWC a robust understanding of the battlespace at the beginning stages of planning is essential to force protection planning for parallel operations.

Appropriate Joint planning Tools that allow the Commanders to understand all resources available to evaluate all force protection options is important.

5.4.2.2 Distributed Collaborative ASW Search Planning

EO1-2 EO3-7, 12, 13 EO5-4

The experiment objective to examine ASW collaborative sessions between the SCC, USS John Young, PATRON Bahrain, and an in flight AIP P-3 was not achieved to the level of robustness

desired. Principal factors contributing to this included communications degradation, and experiment execution shortfalls.

Although the experiment did not identify the methodology to yield a higher probability of detection (Pd) compared to the aggregated Pd of the independently developed platform search plans, limited collaboration between nodes still generated findings that are important to understanding the maturing DCP methodology concept.

It is critical that a DCP methodology or process with appropriate TTP's fit within a disciplined planning/battle rhythm scheme.

The SCC's ability to display a near real-time COP, with in-situ sensor performance data from each ASW node is essential.

The ability to display a force search plan and have supporting computational data that identifies the advantages and disadvantages of the plan implementation is important. This allows an understanding that helps optimize the search plan to eliminate the potential gaps or holes that an adversary submarine could exploit.

The near real-time ASW COP also becomes essential for parallel operations planning, particularly for force protection planning aspects.

5.4.2.3 *In-Situ Environmental Data*

EO3-4

The ability of collaborative ASW nodes to pass ASW sensor performance predictions based on in-situ environmental data to the SCC was important to the development and maintenance of a force level search plan.

In addition, the sharing of in-situ environmental data was a critical contribution to the SCC in maintaining a netted sensor effect situational awareness that supported parallel operations planning with the MIWC and JFMCC.

Although up-to-date environmental data may not always have a significant advantage over historical data, small differences may be useful and should be exploited. Therefore, a frequent updating of the in-situ environmental data should be an integrated part of Distributed Collaborative Planning (DCP) and the operations that follow.

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6.0 COMMON RELEVANT OPERATIONAL PICTURE

The CROP is a very complex system and obtaining definitive results experimentation is quite difficult. It is a mixture of systems, people, pipelines, processes, information, information display, etc. etc. The results reported here address a number of aspects, including the C4I architecture. A network analysis is presented in an Appendix.

6.1 ISSUES ADDRESSED BY FBE-F

Issue 1. *Did the CROP enable improved synchronization of Joint operations?* Synchronization is addressed mainly with respect to protection of MIW forces and management of sensors for strike operations.

Issue 2. *Is the information in the CROP accurate/secured/assured and available in the time required by the user?* Recommendations on information content are scattered throughout this report. Security and accuracy are not addressed.

Issue 3. *Did the CROP enable rapid, highly informed decisions?* The CROP experimentation dealt mainly with information content rather than speed.

Issue 4. *How should information be presented to the commanders in order to provide them with the greatest degree of battlespace awareness possible while also focusing them on those critical areas that require their immediate attention and action?* FBE-F experimentation dealt with information presentation for tactical control of sensors rather than commander's situational awareness.

Issue 5. *How will confidence or the estimated degree of accuracy be represented in the CROP?* No information obtained.

Issue 6. *How should information be input into the CROP in order to insure that it is valid?* There is information on what should be in the crop but none that directly addresses validity.

Issue 7. *How will the conflicting information be adjudicated?* No information obtained.

Issue 8. *How will near-real-time information on the adversary and the environment be fused with baseline information from interactive databases and with own friendly force information?* There are a number of results on fusing sensor and target information, and on the need for fusion of updated real-time intelligence information.

Issue 9. *Is GCCS being used to generate a common picture?* Yes.

6.2 C4I ARCHITECTURE

6.2.1 FBE-F Observations and Issues

EO5-All

One definition of the Naval C4ISR Architecture is that it is the network providing the infrastructure on which Network-Centric Operations (NCO) are conducted. The NWDC Capstone Concept for NCO is taken as the defining document here. According to it, NCO has the objective to "enable the Navy after Next to decisively win in the littoral and on the high seas". NCO " derives power from the robust, rapid networking of well-informed, geographically dispersed warfighters to create a precise, agile style of maneuver warfare and overpowering tempo…to sustain access and decisively impact events ashore". The Naval C4ISR Architecture supports command and information relationships that allow NCO of the Navy and Marine Corps and related Joint elements.

The FBE's are testable excursions from today's Navy, so it is not surprising that NCO can not fully be executed in the FBE. But FBE has shown significant steps toward NCO. Future implications and implementations have become clearer through the FBE process. Architectural issues and deficiencies have become obvious in the FBE's. The architectural deficiencies include:

- Doctrinal (no command/information relationship specified but found needed),
- Interoperability (relationship implied but not feasible),
- Connectivity /capacity /timeliness (relationship enabled partially, slowly etc)
- Semantic (relationship implemented but not understood)
- Noise level (relationship implemented but overwhelmed by competing inputs)

Some of the architectural deficiencies in FBE-F are mentioned below. Unfortunately training deficiencies may mask, or falsely indicate, deficiencies of an architectural nature. Some of the deficiencies below may only indicate lack of training in the existing architecture or its experimental extensions, which only once again indicates the crucial role of training in NCO.

6.2.1.1 C4I Deficiencies

EO5-All

In FBE-F, although many new concepts were investigated, architectural deficiencies were found in areas of parallel mine and ASW warfare, integration of operations with collection management, targeting across weapons types, and NBC efforts.

In FBE-F the timeline for clearance of straits was to be reduced through synchronous antisubmarine and mine warfare. C4ISR deficiencies were minimized by the co-location of the MIWC and the SCC. There are severe bandwidth capacity constraints in reaching the mine warfare ships, which prevent the COP from being distributed to them. The COP which, as a work-around was distributed via GCCS because of SIPRNET problems, was, not surprisingly, judged unable to support synchronous operations because of time latency and accuracy deficiencies.

US Army Apache helicopters were successfully vectored to support mine warfare ships by the SCC. Doctrinal and IFF deficiencies should be addressed.

The ARCENT Deep Operations Coordination Center (DOCC) was remotely integrated into the fires effort and fired simulated ATACMS missions but additional doctrinal, interoperability, connectivity and semantic deficiencies were identified.

Special Forces units were involved in mission planning but their full utility was encumbered by doctrinal and information deficiencies.

Effects-Based Operations (EBO) in FBE-F were hindered by lack of simulated feedback that could have been provided by simulated ELINT and SIGINT that might have quickly indicated the relative success of fire missions. The role of the Effects Coordination Board and the location of its functions changed during the experiment, perhaps indicating a need for additional doctrinal development.

The concept of an Attack Guidance Matrix (AGM), borrowed from the US Army, was explored to aid in EBO and in reducing the timeline for TCT. This is a promising concept but depends upon accurate capability to estimate target location error and system response time as well as a stable assessment of target priorities . Additional testing and doctrinal development is needed as well as Joint interoperability. TCT suffered from lack of visibility by all participants into the status of Blue response since a sample showed that only about half of TCT designated targets were attacked.

The concept of a Joint Fires Element (JFE) was perhaps the most promising innovation in Foxtrot. It consisted of a sensor grid (ISR cell with feeds from national , theatre and organic sensors) supported by a GISRS-M terminal, an information grid (targeting cell with MIDB target data base) supported by a PTW+ terminal and an engagement grid (fires coordinator) supported by a network of LAWS terminals. In particular GISRS-M provided an important new capability for local collection management that makes it possible to deal with Time Critical Targets (TCT) much more expeditiously when combined with LAWS and the PTW+. Connectivity to the UAV controller was particularly important in tracking of moving TCTs.

The AGM was useful to the GISRS-M operators but adaptation to a collection planning and execution aid is desired. Doctrinal changes such as the integration of the J-2 and J-3 watches and improved interoperability should be explored. Balancing the number of PTW+, LAWS and GISRS-M terminals and improving their interoperability is required to eliminate bottlenecks when they are not co-located as they were in Foxtrot.

Mobile targets require additional sensors including an organic MTI/SAR capability. Real-world operations limited the assignment of the intelligence staff in Foxtrot. Possibly as a result, responsibility for collection planning was not clear.

Passing of target images from F-14 TARPS-CD pods to GISRS-M is a promising concept for finding targets that was severely handicapped by poor connectivity. RPTS for passing images to the cockpit is also promising but defeated in Foxtrot because of connectivity. P-3 images need to have a longer dwell time on the target as well as location information incorporated with the imagery. Image quality was sometimes degraded in passing through the chain of workstations.

Simulated NBC events were handled in FBE-Foxtrot. The GAO observers felt that NBC was well integrated into the exercise and were impressed with the Collective Protection System. Reachback was demonstrated. A doctrinal difference between the Services and additional interoperability needs work.

In ASW, Distributed Collaborative Planning (DCP) was accomplished but it was found to be difficult and time-consuming and required a strong leader, preferably on an ASW platform. Much was accomplished by UHF voice rather than high bandwidth means. Improved fusion and connectivity is still needed.

6.3 COMMON RELEVANT OPERATIONAL PICTURE RESULTS

EO5-All

The participants in FBE Foxtrot strongly stated that the CROP supplied to them in Foxtrot was not adequate to support targeting of land attack missions. This raises three related analytical questions of consequence:

- Was the CROP in Foxtrot unusually poor?
- Does the CROP ever contain adequate information to support targeting?
- Should the CROP be enhanced or should other means provide targeting quality info?

It is asserted here that although the CROP was unusually poor in Foxtrot because of restricted equipment availability and displaced geometry.

The CROP is a joint situational awareness tool and may never be adequate for total support of targeting. Target information is applicable to small subset of the objects that are relevant to situational understanding and targeting has a much higher quality of information with regard to accuracy of location, latency etc. A special set of targeting folders and/or a targeting net is necessary to support targeting and is dependent on the sensor and weapon combination being employed. Targeting support and authorization are likely to remain the responsibility of joint level commands for some sensor ñ weapon combinations with other combinations necessary to unit survival being localized and tightly integrated.

The CROP can be of use in supporting targeting with information concerning the situation surrounding the target, which may be difficult to put in the target folder or on the targeting net.

Many participants in the JFE expressed strong feelings that the CROP did not provide adequate information support for targeting of TCTs. Most of them seemed to be concerned with latency and incompleteness and inaccuracy of the picture. Others have suggested that the CROP (or at least the Land Attack TCT Common Tactical Picture (CTP) if it were to exist) should have additional information that it does not now have such as:

1. Sensor data: sensor location, target location error, footprint and pointing data
2. Full TADIL information and track history for each target
3. Imagery: video from UAV with telemetry info and NITF images
4. Related near-real time SIGINT and possibly COMINT, MASINT
5. GMTI track (JSTARS) info and position location info (tags) concerning targets.

Some conceptions of a targeting-oriented CTP include the addition of information concerning the firing status of friendly units, some representation of the priority of the targets and even confirmation of authority to fire.

Although all of the above information would be useful in a Joint Fires Element, clearly these requirements go far beyond the current capability of the CROP. The CROP is first of all a situational awareness tool. As such it must cover a broad area such as a theatre and is literally a picture in order to enhance comprehension. It therefore has a limited level of detail and less than instantaneous latency. It is a joint and often a coalition service that must be available to those with only Secret clearance or often even less.

Historically at sea the CROP is closely related to the tactical air picture with all tracks of ships and aircraft: friendly, neutral, unknown and hostile/potentially hostile. Because of the cognitive objective of the CROP, it is usually screened by a human operator for clean-up of dual tracks and the categories listed in the previous sentence which are based on many inputs for identification. Often only this operator (FOTC) is allowed to add tracks, change categories, see highly classified inputs etc. The CROP as seen today is simply not a targeting tool. Targeting requires additional tools as such as target folders, sensor links and targeting nets. To ask the CROP to perform these functions is to overload it and restrict its dissemination.

During FBE-F the CROP was severely limited by the real operational situation which did not allow direct connection to the tactical link pictures. In addition, the MIREM and SHAREM exercises were positioned at a distance from the areas of interest to Foxtrot so that a virtual displacement of locations was necessary for the Foxtrot scenario, which made correlation to actual locations difficult. As a workaround, LAWS was able to display an extraction/modification of the GCCS-M picture. It is well known that the GCCS picture (although defined by some to be the CROP) has notoriously bad latencies and often does not contain all traffic: air, surface and sub-surface but only selected units of high interest. Moreover there was some differences between the LAWS CROP aboard the Kennedy and the one in Bahrain because LAWS had different servers and these were not totally synchronized. Thus the CROP used in Foxtrot was not even a particularly good situational awareness picture.

However, even the best CROP will not adequately provide all the information necessary for targeting. Situational awareness concerns thousands of objects, some of which may be conjectural but important. Targeting focuses on a much smaller number of objects but in much more detail. As an operational level, CROP situational awareness tool simply cannot be expected to have the focus, latency and dissemination for targeting. Targeting requires extremely short latencies (at least for some targets), very accurate location and firm identification of just those objects that may be considered for attack.

It has sometimes been suggested that a Common Tactical Picture (CTP) might be developed that is the tactical equivalent of the CROP but more inclusive of localized targeting information and with short latencies. For AAW this would describe some aspects of the Cooperative Engagement Concept (CEC), for example. However compared to the Land Attack picture, CEC has certain advantages of a localized geometry with small number of objects with relatively good identification (IFF), small number of participants on the net, precision sensors (SPY phased-

array radars) and very high bandwidth line-of-sight communications. An equivalent CTP for land attack is simply not technically feasible or affordable because of the larger number of objects, greater distances, diverse sensors, and lack of bandwidth. It is not likely that a CROP or even a CTP will soon be able to provide all the information required by land attack targeting.

The CROP or perhaps eventually a CTP can provide important background information for targeting. Because of its wider perspective, the COP can enable additional identification information (launch area of a missile for example). It can provide an understanding of the location and status of friendly units which might provide targeting quality information or fires or BDA, the potential for fratricide and collateral damage, downwind fall-out casualties etc. Before engagement the CROP can provide significant help in collection management prioritization and interpretation for IPB. It can serve as a way to pass important sectorization decisions and serve as one basis for collaborative planning.

If the CROP can not practically provide all necessary targeting information, how can the information needs of targeting be met? A combination of IPB and dynamic targeting folders, direct sensor- weapon threads and perhaps some specific targeting nets is likely to be crafted for specific land attack scenarios rather than a general purpose broadcast of all targeting information. The reasons for this, in general, is that the targeting information is specialized by type of weapon and is often restricted in its releasability/dissemination both for classification and simply because of geographical relevance and sensitivity. Moreover, the authorization for attack of some potential targets and use of some of the weapons is likely to be reserved to specific levels of command which may desire to limit visibility into their operations, for security and other considerations.

The information to support TCT targeting and weapon assignment depends upon the combination of target type and weapon type that are being paired. Although having all the information necessary for targeting (all types of weapons might facilitate the most efficient pairing of weapons and targets) for TCT, it is much more important to be able to quickly make a feasible pairing with the information in hand than to wait for all information on which to base an optimal choice.

Two target types most relevant to TCT are moving (or relocatable) versus fixed. Fixed targets can have an electronic target folder prepared in advance that contains all of the required location and mensuration, collateral damage and other limitations concerning ROE. All that is required in real time is the time-critical status of the target and the location of friendly or neutral units. A CROP could provide this (if it could be injected with minimum latency) in addition to the target folder.

For moving targets, the task is much lengthier because the interpretation, location, identification and mensuration must be established and the assessment of collateral damage and ROE must be performed after the detection of the target. This information is not possible to file ahead of time so an electronic target folder must be built before the target can be authorized for attack (some portions could be done in parallel). Moreover there may be a long period between when the first sensor is alerted and the actual detection of a potential target since Automatic Target Recognition (ATR) is still relatively ineffective. Therefore moving or relocatable targets are quite difficult to

target within the usual TCT thresholds of between 5 minutes and a few hours, almost regardless of the weapon being used.

From the sensor standpoint, often TCT sensor provides some kind of imagery: video from a UAV, national SAR or EO imagery. This generally allows rapid identification and reasonably accurate location but may require mensuration. Other times the TCT sensor is only an IR launch warning or SIGINT event or HUMINT / MASINT report. It is anticipated that JSTARS like capabilities will provide TCT over land and that distributed ground / water sensors will also provide detection (and identification in some cases). Generally a fusion of this information or correlation with imagery is necessary before the target location and identification will reach acceptable completeness for attack.

From the weapon and weapon platform standpoint, the usual response to a TCT is to vector an aircraft already in the area to make final identification and destroy/suppress the target with whatever armament is on board. This requires almost no information beyond an approximate location and description (some information about defensive activities in the area would also be desirable). On the other hand if the weapon at hand is a missile that cannot be controlled once it is launched (Tomahawk or ATACMS) then very precise information regarding location and identification must be available. Gunfire support may fall somewhere in between in information required. The 16 sensor-weapon threads planned for Foxtrot show in detail the information required for each pairing. It should be possible to identify the expected time for these 16 evolutions for comparison against the TCT thresholds.

Inspection of the LAWS data from Foxtrot reveals that no missions were performed within the specified time window and that very few missions were executed within the usual TCT thresholds. In addition only about half of the TCTs had missions generated.

In the case of a moving or relocatable TCT with short thresholds, the only hope for successful execution is that an imaging sensor is under the control of (or in direct support of with very good connectivity) the JFE fires planners (LAWS in Foxtrot). In Foxtrot a simulated UAV was available to the GISRS-M operators and the UAV sensor display was available locally. It was therefore possible to locate, with some degree of accuracy, and to identify the TCT. Because LAWS had sporadic information on status of friendly firers, it could begin to assess firing options while the target was being mensurated and a reasonably rapid firing assignment that was likely to be feasible could be made.

Authorization of higher levels was not necessary in Foxtrot simulations and firers were supposed to report back via LAWS when performing the simulated execution. Thus the firing loop could conceivably be closed in a reasonably short period. In effect the Video from the UAV plus its controls became a targeting net supporting LAWS.

Targeting nets for TCT, in order to provide identification and short latency, will need to have imagery support directly from the sensors and a close degree of sensor platform control of the sensor. They must also have very tight connection to fires. But for effects-based prioritization, re-tasking of strike platforms and deconfliction, the targeting net must include a node with broad understanding of the current status of the operations and with authority not only to direct fires

but to re-task platforms that are performing lower priority missions. This must be a fairly powerful node with quick access to responsible command levels. It must be supported by a good CROP as well as the much more restricted targeting net(s) and have extensive intelligence support from national sources probably through a Joint Intelligence Center. In a large-scale joint or coalition operation this node will have to have be at the JTF level and have the commanders personal blessing because of the necessity of intervening in on-going missions in order to respond to TCT as well as high priority for intelligence collection and sensor management.

One of the demands for responsive intelligence collection and interpretation is that for any type of TCT target and weapon it is important that BDA be obtained in order to decide when to stop firing. Because TCT are so important, re-strike will be necessary until confirmation that the desired effect on the target has been reached. The planning of BDA should occur with every fire mission pairing. Otherwise it is likely that the BDA will be delayed to provide useful information for restrike decisions and many weapons will be wasted.

6.3.1 Sensor Related Common Relevant Operational Picture Issues

EO1-2 EO3-2 EO5-All

The following are some specific recommendations with respect to CROP configuration for sensor management by the ISR desk.

- Incorporate a means for generating and displaying ISR collection routes in the ISR situational awareness display.

- Immediately pass track reports to operational nodes for "see and avoid" while TCT nomination is ongoing.

- The ISR desk needs to know from Operations the status of TCT nominations as a driver to collection/processing refinement.

- The CROP could allow analysis and use of imagery by other forces prior to aircraft return to the carrier.

- At all stages of the targeting process, there should be available a target management/status function that shows priorities, target flows, and situational awareness.

- Specific experiment ISR sensors should input data into the CROP via TCP/IP gateway.

- Need 100mb ethernet minimum for build/distribute CROP.

- Need non-actionable targets in the CROP.

- The ISR desk needs a real-time CROP containing the following to support the TCT process:

  Video from UAV and P-3
  Tactical Data Link information on friendly/hostile force locations

NITF imagery from tactical, theater, national sources
TCT nominations
Uncorrelated near real-time SIGINT information
JSTARS (APY-6)/GMTI track information

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7.0 FBE-F ORGANIZATIONAL CHANGE

EO1-1, 2 EO3-4, 7, 12, 13

Organization design: Over the course of FBE's it has been learned that by bringing decision makers, operators and staffs together with sufficient C2, planning tools and situational awareness through a COP, organizations that are adaptive may evolve. Organizational experimentation is therefore a large dimension of the overall experiment. Much of what is understood from FBE experimentation is not explicit, but the result of interactions between participants, processes and technology. Organization change in general includes many dimensions, and understanding relationships between them.

What follows in this section are highlights from observations, interviews and analyses, arranged by principle experiment organization areas. The intent is to surface many different areas of interest. Some of the commentary is related to experimentation in general, which is of interest to future experimentation. For many of the participants it was difficult to separate experimentation from capabilities. In other words, much of what was critiqued by participants was related to the design and execution of the experiment, which was difficult to separate from larger issues of *capabilities* implied in the experiment. It is at the level of *capabilities* expressed or implied in these organization interactions that analyses hopes to understand what was most important from the experimentation process.

Organization structure: Commander, Joint Task Force (CJTF) (COMUSNAVCENT, C5F) was OCE for the experiment operations. Experiment control was exercised by Maritime Battle Center, in conjunction with a C5F exercise, ARABIAN MACE. Directly under the CJTF were the Joint Forces Maritime Component Commander (JFMCC) (principally naval forces, including an ASWC and MIWC), a Joint Forces Land Component Commander (JFLCC) (principally U.S. Army ground, ATACM, MLRS and Army Aviation units) and a Joint Forces Air Component Commander (JFACC).

7.1 JOINT FORCES MARITIME COMPONENT COMMANDER

General: The Joint Forces Maritime Component Commander was aboard the CV. Of the three joint warfare commanders, the JFMCC held the largest responsibility and the preponderance of forces. Although tactical air (TACAIR) was coordinated through the JFACC, the assets were part of the forces reporting directly to the JFMCC. In addition, the Surface Component Commander (SCC), Anti-submarine Warfare Commander (ASWC) and the Mine Warfare Commander (MIWC) were collocated and coordinated planning directly with the JFMCC. Multiple roles and responsibilities that merged joint warfighting with largely naval JMAC operations required additional organization design to couple JFMCC to deliberate strike planning and production of an Integrated Task Order (ITO), effects-based targeting as part of Strike operations, and to TCT processes.

Organization relationship: The role of the Guidance, Apportionment and Targeting (GAT) ashore was to coordinate JFMCC efforts with the JFE, represent the JFMCC at the ECB and the JTCB and in all other domains. A liaison officer from JFMCC was assigned. Difficulty arose from a

lack of direct interaction between the LNO and the modeling and simulation which were part of the battle space that required coordination.

Organization relationship/authority: (GAT) set up ashore did not overcome a command and planning barrier which resulted from concerns by the JFE that although they were working with the GAT, in actuality they were speaking to the JFMCC. In other words, the GAT ashore carried the weight of the JFMCC. This was potentially a good situation except in the condition in which the GAT was not adequately linked to the JFMCC's intentions and concerns. There is evidence that this was the case early in the experiment, but that the situation improved as the experiment and connectivity continued.

C2/organization relationship/synchronization: Improved connectivity was noted between days 3 and 4, producing a potential for JFMCC/JFE coordination which shifted perceived responsibility of the JFMCC GAT ashore directly to the JFMCC. This resulted in a very close coupling between JFMCC and his warfare commanders, and the planning and execution planning cycle being conducted ashore in the JFE/Fires cell. This is evidence of synchronization, and of organizational learning. This also highlights that the GAT role need not be institutionalized throughout the life of the operation, but be phased in and out of the ops as the organizations involved develop the competencies to engage strategic and tactical problems in a distributed environment.

Organization relationship/synchronization: "We (JFMCC) think our contribution was very important to understanding interactions between deliberate planning and dynamic TCT operations. We think we had a much better understanding of how to do it, and that overall our planning execution synchronized the operation to actually fit very well within the JFE organization. We had good coordination with the JFACC and we think we delivered a much stronger assessment of the JFE product to the CJTF."

Organization change/adaptation: Organizational change about day 5 in which functions of JFE ashore were reversed, becoming a GAT cell afloat in which the JFMCC would become strike lead.

Synchronization: Coordination effort between planning, battle rhythm, and execution enabled a unity of effort at the JFMCC level. "When the JFMCC came to the table with the other components and the CJTF at the morning (VTC) meeting, the staff already had prepared for higher authority what JFMCC had planned, what the status of operations in the last 24 hours was, and the proposed scheme of maneuver for the next 24 to 48 hours. With improvements in the COP what developed was our own method for interacting with the staffs, watch captains and the infrastructure ashore. The tight decision loop could be a model for what the CJTF will expect out of future battle groups in successive CPX's and experiments."

Organization relationship/design: A problem was noted with regard to continuity of requirements and missions that would have coupled JFE and JFMCC: an LNO from JFMCC was not included in the JFE strategy cell. "We really didn't have a JFMCC interface or insight into the kind of direction we wanted to go (which was) sort of a main effort for the JTF." This caused the Strategy cell to "extrapolate" and to bridge their interpretation of commander's intent with

JFMCC operations. Result was a discontinuity between CJTF intent, strategic planning within the JFE Strategy cell and operational planning by the JFMCC. End to end chain of intent to targeting was therefore not possible.

Insight/Recommendation: One concept that emerged was the possibility of a "Joint Force Fires Commander" (JFFC) based on preponderance of forces, operationalized by a JFE/ECB. In FBE F scenario this would have been the JFMCC, supporting the CJTF and supported by the JFACC. This was tried in the last two days of the experiment and worked well. In this case the GAT would be collocated with the JFMCC and strike planning would continue either ashore or afloat as the situation dictated. This is especially important at the beginning of the campaign, in which there are large numbers of TTLAM/TLAM followed by ERGM/LASM and TACAIR. If this is phase 1, then continuing with a second phase may include redistributing responsibility for GAT and ECB along with a JFE, all still working for a JFFC. In a third phase, which is synchronized with the parallel operations necessary to the conflict, JFFC may become the JFACC, with JFMCC supporting and the associated JFE/ECB becoming part of this staff. In the littorals (and JMAC type missions), this is the likely case scenario. Handoff between JFMCC/JFE and JFACC is analogous to the CATF to CLF handoff in an amphibious operation. JFACC is an established Joint doctrine, and this notion fits within that notion, but also establishes a Navy role for a JFE-like function when first on scene as part of a land or littoral campaign.

7.2 JOINT FORCES AIR COMPONENT COMMANDER

As a result, the experiment JFACC was stood up with the minimum personnel and capability necessary to keep the experiment moving. Additional requirements for integration of JFACC functionality into the effects-targeting process added another dimension to JFACC organization capability. JFACC processing capability was necessary to developing the Master Air Attack Plan (MAAP), and integrating the Master Surface Fires Plan and Master Land Attack Plan, which were constructed by the other components and integrated by the JFACC. This validated a JFACC-like capability, necessary to building coordinated and synchronized fires plans for targets assigned in the ITO by components and warfare commanders. In a Navy littoral scenario in which the Navy is responsible for access, this capability will be necessary. As demonstrated in FBE F however, the capability can be met by a much smaller organization than the fully manned JFACC. As access is accomplished and greater number of joint forces arrive in theater to support infrastructure building, the role of the JFMCC-centric JFACC capability would move easily to the fully functioning JFACC.

Organization design/doctrine: Another consequence of the scaled-back JFACC is that a GAT (Guidance, Apportionment and Targeting cell) for JFACC was found to be useful. A similar organizational capability is also necessary for Naval Surface Fires mission processing. During the final two days of the experiment a GAT-like capability, which included some JFE function was set at the JFMCC. This essentially provided JFMCC authority to employ direct support aircraft in his AOR for prosecution of tactical operational time critical targets.

Organization relations: Commentary made (reiterated many times) that the relationships between JFACC, GAT and ECB were blurred. Participants did not understand the difference between

these organizations, and most felt that what they were doing was equivalent to the same activities they had previously done in other organizations that simply were called different names.

Organization design: Several participants in FBE Foxtrot noted the need for a "Guidance, Apportionment and Targeting (GAT)' Cell to support the use of Naval Fires by the Joint Fires Element (JFE). It is believed that the functions performed by such a cell would allow the JFE to complete the detailed assignment of targets to naval fires in a shorter time and more confidence in their integration with other fires for joint effectiveness.

Historically a GAT cell is a shortcut means of providing / interpreting the joint commanders intentions, apportioning resources to efforts and generating a target list. Doctrinally these are each lengthy processes that are performed according to joint doctrine through a Joint target Coordination Board and the ATO generation process. There is no GAT cell in joint doctrine but one did perform very important planning and monitoring functions in the Gulf War.

Naturally the same guidance, apportionment and target development processes that are appropriate for predominately aviation- delivered munitions (which have traditionally included both Naval aviation sorties and Tomahawk strikes) may be appropriate for Naval fires of other types such as ERGM, LASM etc. During Foxtrot the JFACC cell performed some of these functions for aviation sorties and generated an ATO. They may have been referred to by some as the GAT cell at times. The term may also have been applied to the JFE itself by some participants, particularly when the JFE was moved in part to the USS Kennedy, but others remained in Bahrain. There was no GAT cell formally.

These circumstances alone could explain the perceived "need for a GAT", but is likely that in addition it is also due to the focus of Foxtrot on pursuit of Time Critical Targets (TCTs) by Naval forces, primarily non-aviation. Therefore, there is currently no doctrinal methos for dealing with TCTs. Since, in examples as the Gulf War, TCTs were dealt with primarily by the assignment of SCUD CAP aircraft that would loiter in an area waiting for targets to appear, the activity was largely handled on an exception basis by the JFACC. Because Foxtrot focused on the non-aviation resources to respond to TCTs, it is not surprising that there was a perception of the need for a cell (or set of processes) that would ensure that the JFEs actions to pursue TCTs are in accordance with the commander's guidance, do not conflict with other uses of the Naval resources, and strike an appropriate, not simply a feasible, set of targets, i.e. the GAT processes. For example, it would be desirable to have an authority to approve the assignments by the LAWS operators of weapons to targets (or at least someone at a higher level to discuss the issues that might be involved in a timely manner). A GAT cell, if it existed and had doctrinally defined functions and authority, could provide such support. The guidance, apportionment and targeting processes have traditionally focused on pre-planned operations and the ATO. When TCTs become important and the ATO is impacted, there is no current approved doctrine for how this is to be handled. In fact the Joint doctrine status board reports that the development of Tactics, Techniques and Procedures (TTP) for Time Sensitive Targets is being separated from the draft publication JP 3-60 Doctrine for Joint Targeting as JP 3-60.1 JTTP for TST.

Therefore there is no doctrinal method for dealing with TCTs currently. Since in the past, such as the Gulf War, TCTs were dealt with primarily by the assignment of SCUD CAP aircraft that

would loiter in an area waiting for targets to appear, the activity was largely handled on an exception basis by the JFACC. Because Foxtrot focused on the non-aviation resources to respond to TCTs, it is not surprising that there was a perception of the need for a cell (or set of processes) that would insure that the JFEs actions to pursue TCTs are in accordance with the commanders guidance, do not conflict with other uses of the Naval resources, and strike an appropriate, not simply a feasible set of targets, i.e. the GAT processes. It would be desirable to have an authority to approve LAWS operators assignments of weapons to targets (or at least someone to discuss the issues that might be involved at a higher level in a timely manner). A GAT cell with doctrinally defined functions and authority could provide such support.

Lacking a doctrinal GAT, what coordination point would be appropriate for the JFE? For a JFE primarily concerned with TCTs, it would make sense for it to coordinate with the JFACC TCT cell if it is in existence. This would de-conflict duplication of attacks. If a JFACC has not been established or is internal to the JFMCC, coordination of the JFE becomes trivial unless extensive USMC, US Army or Special forces are involved and or exposed to the fires pursuing the TCTs. Lacking a JFACC and with extensive participation of the other Services, it might be advisable for the JFMCC to establish a cell for allocating Service efforts and coordinating / authorizing attacks on specific TCTs. It might be confusing to call this a GAT, but it could be so named.

7.3 JOINT FORCES LAND COMPONENT COMMANDER

The Joint Forces Land Component Commander included primarily U.S. Army forces stationed in the immediate AOR, which would be available in the 2003 time frame of the experiment. JFLCC was set in Kuwait, and used the Army's Deep Operations Coordination Cell (DOCC) as the primary means for integrating and coordinating operations, synchronizing with other joint warfare commanders and the CJTF.

"What we were trying to do is integrate Army capabilities into the digital fires network that we set up among ships, from headquarters here, and try to prosecute missions using Army land-based assets in a mostly Naval environment."

Organization structure/joint: The DOCC is doctrinally rigid, and operates on a prescribed set of inputs to their processes, and produces a set of specified products. Language is very important to the operators and planners in these processes, and there were ambiguities in the language used to plan and coordinate between other warfare commanders and the DOCC. One observer noted the distinction between USN "nightly intentions" intentions type of direction, contrasted to the expectation for more direct and dynamic Commander's Intent. The result was some ambiguity about the CJTF's intentions at the DOCC level.

Organization/feedback: Feedback from Army missions was difficult to inject back into JFE/JFACC planning. An example of this was the attack guidance matrix. "The attack guidance as a device was there, but there were problems: One, constructing it, and two, it was difficult to use because the process to disseminate information was not mature. Elements within the AGM were fed back piecemeal through their LNO (liaison officer) so that the strike cell could go ahead

and do what they needed to do." (this comment is specific to production of an attack guidance matrix to be used in prosecuting land-based targets).

Organization/C2: One intention of the organization structure in this experiment was to "flatten" C2 and roles. There was some impact of this structure, as evidenced in the comment; "we (JFLCC) did some things you normally don't see. Most of it was in simulation. But, normally you don't see elements within the JFMCC reaching through and coordinating fires with the Army guys. The network allowed them (commanders) to flatten the command structure. Of course, we weren't firing missions without the approval of the JFE, especially time-critical missions. But, we were using a very flat command and control system to effect coordination between elements. In that, it worked quite well."

Another indication of this was the coordination of Army Apache helicopters in a MIW defense role.

7.4 EFFECTS COORDINATION BOARD

This section describes effects Coordination Board (ECB) relationship to the experiment, considers future weapons systems within a maritime battle management context, how to use the ECB in the conduct of Effects Based Warfare, and how to stand up a JFE and ECB as part of a Navy-centric CJTF.

The following is a collection of individual observations/opinions. No attempt has been made to correlate them with other facts to test their validity.

ECB is really a GAT: "I've been on every ECB for the last three years in the real world. It is called the Strategic GAT cell at JFACC, and that's exactly what we do." According to this officer the mission of the GAT was subsumed within the ECB, but when the long range weapons such as TLAM and TTLAM, LASM and ERGM were also employed, then the role of ECB as GAT became more apparent even though it may not have been called by this name. Interesting to note that the TLAM was characterized as a precision Air-to Ground weapon under this definition.

Guidance was a problem in Desert Fox, and is reiterated as a problem in the experiment. Effects based targeting is highly coupled to understanding evolving commander's intent.

Intelligence/Feedback: Although still a problem, commander's intent was somewhat better than Desert Fox. Another area of concern in the experiment was a lack of realistic intelligence that would normally be a part of the decision making process for prioritizing targets. This is an understood artificiality in the experiment (expected), however, this also points out the association between GAT/ECB and intelligence providers. This coupling is another kind of feedback.

LASM/ERGM/TTLAM relationship: "We have a lot of Tomahawk Knowledge here. Also, to use the other weapons you have to get closer." Reason for the high early usage of

TLAM/TTLAM. "They (planners and targeteers) don't have a lot of true knowledge of what LASM and ERGM can do."

Parallel OPS in Strike: Point about paralleling strike ops means that some sequential events also have to take place. For example, use of 300 TTLAM the first few hours of the attack to suppress enemy SAM sites and associated C3, followed by the B-2's, B-1's, B-52's, F-18's, F-15's etc. that are in parallel at that point with the ERGM and LASM which can now get in close enough to be used. According to these respondents, there was very little of this thinking occurring in the Strike process.

Parallel OPS and tools/ feedback/SA: "We (ECB) had no idea where anybody was, or how they were operating or what they were doing, unless we walked into the JOC and took a picture." This comment is also about the need for feedback with regard to the tactical picture and effects. Judgment by this observer was that SA was low in the ECB. Characterized as "nonexistent" by another observer. Only potential for SA was via two laptops that were part of SIPRNET LAN. Other than electronic connectivity, SA was obtained directly through the morning brief..

BDA Feedback: Lack of BDA to ECB made it difficult for the ECB to understand contributions of planning to effects.

Organizational relations: (Reiterated many times) The relationships between JFACC, GAT and ECB were blurred. Participants did not understand the difference between these organizations, and most felt that what they were doing was equivalent to the same activities they had previously done in other organizations that simply were called different names.

Organizational ambiguity : Question around who does the function of "current operations." Usually a "current operations" planning cell, however this function may be required to reside inside of ECB or other JFE structure. "It was schizophrenia that we had to deal with, asking continually 'is that Current Ops or is that us?' Because Current Ops does, indeed, need to involve themselves in the effects phase."

Relationship to definition of Effects: Information to the ECB came from the Strategic Plans organization. Example might be "hit mobile TELS because we want to neutralize a chemical weapons threat." Planners in the ECB had difficulty making a distinction between this mission as an "effect" and as an "objective." The distinction was important to the ECB because if the "effect" was to limit the chemical weapons threat, then the ECB's role may have actually been better served by having them plan missions to maximize the effect, e.g., destruction of chemical weapons storage facilities. The requirement for an effect would have to be understood within the context of commander's intent, which would support this mission unless the CJTF's intent was to limit the scope of the conflict by not being overly aggressive. In this case there is a relationship between limiting effects and accepting additional risk, i.e., intercepting TEL's or other potential WMD carrying weapon system.

BDA: "Did we achieve the effects we desired? We don't know. All we did was fix some more targets and keep going."

Organizational: ECB was essentially "a modified GAT." (49) attitude of participants was that the responsibility for targeting should not be maintained in the ECB, but reside in the J-2 staff organization.

Organization coordination: Coordination of target sets occurred between the ECB and J-3 "to ensure that our target set matched the CINC's intentions." Argument here is that this function remain with the J-2 because intelligence manages and coordinates ISR functions, which can include targeting impacts such as human shields etc. (50)

Experiment objectives were ambiguous: "There's always room for improvement in doing it (targeting), but essentially what they tried to stand up here is not anything new or different." (perspective of USAF officer trained as part of JFACC staff). Problem was also related to the design of the experiment in that other structures were necessary to test the organizational design intended. An example of this would have been the results of intel analysis collection management dissemination or target folder development made available to decision making processes in the experiment organizations like the JFE or ECB. What was provided were targets as place holders (usually from the simulation), however there was no real intel supporting these target sets, while many RFIs were initiated to produce the information that should have been included.

Realistically, it would have been very difficult to recreate JIC functions for the experiment without actually having a JIC to do this. The outcome for all of this was an apparent mismatch of organizations and data which would normally have had a real part within a data-flow system to support the integration of functions represented in the JFE/ECB/JTCB and so forth. This is an important consideration in the development of experiment design. That is, the amount and kind of data that supports the process functions that are being experimented with needs to be planned for, even if canned.

CINC intentions: There may be a distinction between JTF intentions and CINC intentions, depending on the theater. In CENTCOM it will usually be the CINC who will establish intentions, although this is not the way the experiment was conducted. There may need to be a process of adjudicating CINC and CJTF intentions.

Effects Based Operations: The Effects problem in the experiment was associated with a similar problem in GLOBAL 99 wargame. Difficulty was experienced with constructing an operational definition which could be synchronized with an organizational design. "The JPG would hand me something and say 'here is an effect,' to which I said, 'this in not an effect. This is a task or something.' I think we need to come up with a common definition of what an effect is and put that out to everyone so we can march in the same direction."

Negotiations of meanings took a lot of effort in the course of the experiment, and some meanings were never completely constructed to an operational level. Negotiated meanings was important to the experiment, and was at the root of an organizational event at day 3 in the experiment in which the experiment was put on hold. What most people thought of as training, or "bringing participants up to speed," was really a mechanism of creating common understanding around the meanings of concepts and processes unique to the experiment and which were meant to set the

experiment apart from "the normal way of doing things." Getting at what was unique for the experiment was important to the participants and experiment planners, including the notion that all participants be part of the common experiment experience, or "claim to be a part of the same experiment," and share a common understanding of experiment terms as well as a common understanding of processes within experiment areas (e.g., JFE).

7.5 JOINT FIRES ELEMENT

The following is a collection of individual observations/opinions. No attempt has been made to correlate them with other facts to test their validity.

JFE organization relations: Relationship of the JFE to coordination of joint assets: First 2 days of the experiment the POV from JFMCC was that their function was one of response and observation. After the second day this perception shifted to one of a proactive planning role to develop parallel operations with MIW, ASW, Fires and Strike. Success in this role created a tendency for the JFMCC to seek a wider dynamic role using afloat assets.

Communications: Improved connectivity was noted between days 3 and 4, producing a potential for JFMCC/JFE coordination which shifted perceived responsibility of the JFMCC GAT ashore directly to the JFMCC itself. This resulted in a very close coupling between JFMCC and his warfare commanders, and the planning and execution planning cycle being conducted ashore in the JFE/Fires cell. This is evidence of synchronization, and of organizational learning. This also highlights that the GAT role need not be institutionalized throughout the life of the operation, but be phased in and out of the ops as the organizations involved develop the competencies to engage strategic and tactical problems in a distributed environment.

Organization change: There was an organizational change about day 5. The functions of JFE ashore could be reversed; to become a GAT cell afloat in which the JFMCC would become strike lead.

System relationships/ dialogue competence/ commander's intent/ feedback system/ formal relations v. informal practice, Ops officer CCDG-5/ JFE Strategy Cell Chief. Description of process: Joint Planning Group provide "guidance" to JFE Strategy. JFE Strategy processed (using "numbers") guidance into set of tasks, including a list of "6 priorities" as part of this process. Further processing by JFE Strategy to turn tasks into target sets. Also possible to construct target sets that would need to be developed into tasks. Processes and products aligned "to meet CJTF intent." List of targets, vetted against priorities would then be passed to the Effects Coordination Board. System feedback in the form of dialogue between Strategy Cell Chief and the ECB Cell Chief, with little to no direct coordination with the JPG. There was a formal relationship to the JPG, and Strategy Cell was represented at formal meetings, however a dialogue was not engaged.

Problem noted with regard to continuity of requirements and missions that would have coupled JFE and JFMCC: an LNO from JFMCC was not included in the JFE strategy cell. "We really didn't have a JFMCC interface or insight into the kind of direction we wanted to go (which was)

sort of a main effort for the JTF." In the words of the Strategy Cell lead, this caused the Strategy cell to "extrapolate" and to bridge their interpretation of commander's intent with JFMCC operations. Result was a discontinuity between CJTF intent, strategic planning within the JFE Strategy cell and operational planning by the JFMCC. End to end chain of intent to targeting was therefore not possible.

Dynamic Commander's intent had very little impact on JFE Strategy processes. "The original guidance we received was pretty much the same guidance we stayed with throughout."

Organizational relationships: "I think probably the weakest link (in the system) was between us and the JPG. In retrospect we needed one of their guys with us and vice versa." Perceptions of the JFE Strategy cell's job description changed as the experiment progressed. "I think we became more of a future ops cell instead of a strategy cell. I think the JPG should be looked at as the place where future ops are developed in line with strategy." In other words, lack of feedback and clear roles contributed to a sense of ambiguity about the system role for the JFE Strategy cell. This could be rectified by trading LNO's between JFE and JPG, and by developing a competent dialogue around the system requirements of both organization components.

Role perceptions: Other members of the JFE Strategy cell (US Army) did not understand differences between JFE and Army's Deep Operations Control Center (?) (DOCC). This furthered sense of role ambiguity and has implications for employment of JFE as part of a joint operation, synchronization at the level of JFE and Army doctrine, for instance.

Impact of the technology: Technologies did not have a big impact on the way that Strategy performed its perceived role. Only difference in this person's view, from what the normal process would be and the one used in the experiment was that instead of the results of processes going to the JFCC (Joint Fires Center), they went to the Effects Coordination Board.

Organization problem: The JFE Strategy cell was developing Fires missions based on a "Fires CONOPS" which are not "doctrine." Planning for Fires missions was separated from the information that was being generated about the fires missions that would normally have been required to do the missions. "The JPG was planning one thing and then the JFE Strategy cell was over here. (also) "we were handed some guidance, some bullets (from the JPG?), but we didn't know what the underlying intentions were."

TTP Requirement: Although the experiment was stopped for an afternoon in order to conduct group training of participants, the training provided an overview of what the objectives were, but did not explain what was being done to attain those objectives.

System feedback: Strategy is essentially a futures exercise. Projections are made about the status of the operation in the future and some predictive model is used to make a forecast, which can then be used to modify strategy. These tools were not available in the experiment, so from this interviewee's perspective, strategy could not be effectively "played." In other words, feedback was not available for Strategy to conduct modifications. In addition, decision making was similarly described in the ECB as "swag-ing it."

Organizational relationships: Only way for the Strategy cell to make information based assessments was to bring in the (C5F?) Intel officer, and "he would tell us in his opinion what he thinks our effects would have been on them based on how they typically employed themselves and defend themselves." "If we had a different guy we would have gotten a different opinion." Lack of feedback was observed to impact the information processes in the JFE. The ATO cycle did not run for sufficient time so that there could be feedback from the previous iteration.

Organizational coupling through LNO's: The recommendation here is that to be effective the ECB, JFE and JTCB all need to trade senior level LNO's. A problem with this however is that the concept that all of the LNOs will sit around a table and apportion their resources to each other is "apportionment by altruism." However, as this officer pointed out, "they (his commander) don't send me to give things away, they send me to get things."

Air space control authority and weapon-target pairing need to be coupled. In the experiment this coordination was done at the JFACC-component level with the JFE because they were all collocated. If the JFE is not collocated with the JFACC, after the effects-based order goes to the components to construct their master plans, and consolidation occurs in the ITO, then this assumed coordination with JFE needs to be formalized in a feedback process between them. This feedback will be necessary for synchronization.

Early in the experiment (first few days) there was poor connectivity and situational awareness of what was happening with the JFE ashore from the point of view of JFMCC and personnel embarked on the carrier.

JFE organization relationships/ feedback: Strategy cell was more responsive to CJTF intentions than JPG direction. CJTF intentions were more direct, with little change, and because of the lack of clear direction with the JPG, it was natural for the Strategy cell to fall back on the most consistent and useful direction, effectively cutting out the JPG from the tacit system relationships. This is a discontinuity in the JFE system. "We knew the direction the commander wanted to go in, so that's what we based our assumptions on." "Combat assessment and those kinds of things didn't play in this at all, either." In other words, without BDA as feedback, or without JPG guidance, the only way for JFE Strategy to conduct its role was to use static CJTF guidance. From the Strategy cell point of view, therefore, the only part of the experiment that was experimental was the employment of a variety of weapons types that would not ordinarily be part of their decision making process.

7.6 ASWC AND MIWC COLOCATION WITH JFMCC

The MIWC and the ASWC were co-located with the JFMCC on board the carrier. Interview data and analysis of parallel operations conducted between the MIW and ASW forces engaged in the problem of clearing the straits and providing access indicate that there was higher than usual (as defined by participants) synergy, coordination, cooperation and effectiveness of maritime and joint forces that might be at least partly credited to enhanced collaboration.

"Collaboration is a meta-capability that lies at the heart of new forms of competitive advantage in industries experiencing the disintegration of traditional industry boundaries and simultaneous demands to act in both centralized and decentralized ways." (Liedtka, Academy of Management Executive, 1996 Vol 10 no. 2) Although this quote comes from the business environment, the case can certainly be made that the role of information and requirements to push "operational and tactical" decision making to lower levels is relevant there as it is in the military. In a network-centric environment the potential for collaborative interaction increases, and the notion of adaptive centralized and decentralized activities which co-evolve within a battle space problem is self-evident.

"The art of building and sustaining collaborative relationships is a fundamental prerequisite for competitive success…" (ibid.) This is especially true in the dynamic battlespace environment.

Success at achieving collaboration is not guaranteed by technology. In FBE Echo the ASW Distributed Collaborative Planning (DCP) tools employed were sophisticated and capable. Connectivity between nodes was good. Data from this experiment revealed that the difficulties experienced in conduct of the ASW planning problem were related to organizational issues and protocols about the use of DCP tools. For example, use of DCP tools in a hierarchical environment tends to flatten hierarchical roles which can lead to ambiguity with regard to chain of command and OPCON in general. Although this is an intended result of network-centric capabilities, without organization-wide understanding of a role for collaboration, dynamic-collaboration may not be achieved. This was the case in FBE Echo.

Close coordination between the MIWC and the ASWC (and their coordination with the SCC and JFMCC) was successful in FBE Foxtrot. Two warfare commanders meeting together and experiencing the same information at the same time in a communal environment allowed them to engage in collaborative roles which are understood in face to face communications. These communications are sets of routines and protocols in which the two warfare commanders have a great deal of competence. While it certainly could have been otherwise, collaboration between MIW and ASW, towards a common goal, and with overlapping resources was highly successful and produced a decrease in the mine-clearance timeline.

This does not point to a requirement for co-location, as much as it indicates a need for further understanding of collaboration and tools for collaboration. From the point of view of the MIWC, "(In spite of) the best connectivity in the world, when you can't go face-to-face, you miss a lot. Whereas, when you are co-located you are "connected" simply because you are there. An issue that may be reasonably trivial standing alone tends to be resolved before it becomes a bigger issue." Users of DCP technology often assume that the technology itself is a mimic of human interaction and includes the complexities of human collaboration. Evidence however, indicates that besides the technical capability, connectivity and necessity to engage in problem solving, there is a specific competence to collaborative practice not necessarily emergent in current doctrine, technology or practice.

This collaborative or "dialogic" competence is evident in successful face to face collaboration, but just as it is possible for participants in collaborative practice to have low dialogic or

collaborative competence in face to face interaction, it is certainly likewise possible to demonstrate this in a network centric environment.

In short, what has been demonstrated to date in past FBEs and reinforced in FBE Foxtrot is that collaborative roles are *increasingly* important in a network-centric and distributed environment. Technologies to engage in collaborative practice exist and are improving. These need to include a capability for users to tailor information to their specific needs, while also having access to a shared picture that may include multiple domains. Hence, a common data structure that may be tailored at each node is called for. Besides the technologies which provide a *potential* for collaboration, greater understanding of the elements to *competency* in collaborative practice is necessary.

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8.0 EFFECTS-BASED OPERATIONS IMPLICATIONS

EO1-1, 2 EO3-2, 3, 4

Fleet Battle Experiment Foxtrot included an Effects Coordination Board (ECB) as part of the Joint Fires Element (JFE). In general, the purpose of this organization was to provide a means by which Commander's Intent for attaining force objectives could be included in the development of an Integrated Tasking Order (ITO), and in prosecution of time-critical-targets (TCT). Executing the JFE concept highlighted some difficulties with regard to notions of "effects" in general, which should be explored further.

8.1 HIGHLIGHTS FROM FBE-F

1) Definition of Target Guidance Matrix was not linked to dynamics of the battle problem. In other words, effects at the weapon-target pairing level were not necessarily reflective of an "effects" vetting process.

2) Effects coordination was very difficult without adequate and timely feedback from previous tactical events.

3) Integrating consequences of effects into a larger operational and strategic view of shaping the battle-space was not understood at nearly all levels of the JFE and associated organizations.

4) JFE did however provide organizational structures that were a "first cut" at deepening an understanding of the means by which "effects-based" processes might be employed.

The statements above are not offered as evidence that effects-based planning failed in FBE Foxtrot. In fact there were successes. The point here is that the experiment highlighted some wider deficiencies in the notion of "effects" as a basis for organizing forces and advancing a campaign.

8.2 CONCEPTUAL DIFFICULTIES

First, there is a semantic difficulty. This arises from what becomes a circularity of distinctions in defining the class of "effect" apart from that of "objective." The distinction is an important one, but is also one made more difficult by including different perspective levels. In other words, what might be called an "objective" at one operational level (e.g., the CJTF) may also become an "effect" within a more strategic view. One person's effect therefore can be another's objective.

The semantic difficulty arises from another problem—lack of a commonly understood means to make the distinction from a non-contradictory definition of "effect."

A second difficulty arises from the impact of coordinating differences in first, second, third and so forth, levels of effect. Similar to "branches and sequels," planning based on effects cannot be limited to describing first-order effects, but also secondary, tertiary and so forth. Coordination of

potential relations between these different levels of effect may include notions of complexity far beyond current doctrine and organization structures.

A third conceptual notion that is not yet integrated into Effects-Based Operations (EBO) is that of its control functionality. A principle of control theory is that a "regulator" or system of regulators must have the same or greater degrees of control as the system being regulated.

One must think of EBO as a control system, where fundamental principles show us that, for proper control, you must have the correct time constants and degrees of freedom/control. For EBO this means that you need to design the system so that sensing, information, decisions, and the expected reactions you will be monitoring are all matched in time, space, and organizationally. In addition, you have to build in the required feedback loops (and the TTPs to go with them) so that the system can actually be responsive, producing what some people like to refer to as a self-synchronizing organization. If the response time for a portion of the organization is out of sync with the rest, or with what is required, or if required feedback/response is missing, EBO cannot be effective. It takes a significant amount of thought, effort, and testing to produce a dynamic organization of the type needed.

8.3 IMPLICATIONS

1) FBE Foxtrot explored processes related to the tactical level of "effects-based targeting." An organization was defined to operationalize this concept. Effects at an *operational* and *strategic* level will likewise require congruent organization (synchronicity of actions).

2) Sensor management of battle-space and national assets in FBE Foxtrot did not include adequate real-time BDA, essential to associating effects between tactical and operational levels. Inclusion of this system element will require additional asset management control by the JFE, and likely increase the number of sensors and associated C4I.

3) A Coordinated and shared Situational Awareness (or Common Operational Picture) must be integrated into effects-based processes.

4) The battle-space must be understood as a complex and dynamic system. In order to implement EBO it will be necessary for "planning" to identify expected/desired primary and secondary effects. We cannot at this time reliably identify tertiary and higher order effects. Both levels of effects should be presented and promulgated in a document such as the ITO as guidance for an effects control board. Such planning guidance should also include directed flexibility, such as "if this effect is accomplished then that change in operations is implied," which is really a sophisticated prioritization scheme that is effects based (note that the decision to think of producing such planning guidance gets us beyond the semantic discussion of what we mean by the effects; it will be defined as needed for a specific operation).

8.4 THE ROAD AHEAD

The first requirement for moving forward in this concept is to devise a coherent and logically consistent set of system elements that together define "effects" within context of tactical, operational and strategic operations.

A second requirement is to define organizational and doctrinal implications.

The third requirement is to include the two requirements above in planning future war-games and FBEs.

A fourth requirement exists; to determine what tools are necessary that will allow notions of "effects" to be implemented in the dynamic battle-space.

When EBO is discussed it is most often in the context of Blue goals and operations We have made the point above that one has to be clear about the level of the effects, strategic, operational, tactical, or some combination. It is important to recognize that a parallel consideration has to take place concerning Red intent; what are their strategic, operational, and tactical goals. Attention also needs to be paid to matching Blue and Red levels of intent/effects.

Consider the following example. If Red intent is to achieve the strategic effect of disrupting the support of our coalition partners, a near term operational goal could be to deny Straits access for 14 days. They could reason, probably correctly, that a disruption of that length of time would put tremendous pressure on the coalition. Our operational goal could be to clear the Strait in 10 days and one or more effects could be associated with it. But, what is our strategic goal in countering the Red strategic goal? Clearly, it is to preserve the coalition and to preserve our influence in the area. One of the effects associated with this is certainly to restore the flow of oil. There are others. The point is, that if one is to properly consider action/counter action, goals and effects considered have to be at the same level if one is to properly assess capabilities and consequences.

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APPENDICES

A. FBE-F EXPERIMENT DESCRIPTION

FBE-F was conducted 30 Nov through 8 December 1999 in the COMFIFTHFLT (C5F) Area of Responsibility (AOR). As an overarching principal, the focus of this experiment was to gain insights that will lead to improved future combat readiness and interoperability of U.S. forces through application of future concepts, doctrine, and technologies to an existing USCINCENT CONPLAN. Specifically, FBE-F focused on defining future warfighting capabilities required to conduct SLOC/ASLOC access mission requirements within the expected future context of this AOR. Future requirements include domains of C2, technological, doctrine/TTP and organizational relationships. FBE-F extended maritime dominance to a littoral environment. Conceptually the hypothesis is that new warfighting concepts (doctrine, TTP and organizational) supported by technology advances, permit the Navy to enter and remain in the littorals indefinitely. This is accomplished by combining maritime forces with Joint Forces to provide intelligence, fires, Command and Control, logistics support, and protection of forces afloat and ashore. Technology multipliers in FBE-F explored maritime dominance enabled by an improved common operational picture (COP). Improvements to the COP included improved access and processing of target information in support of responses to Time Critical Targets (TCTs), enhanced situational awareness (SA) of the undersea waterspace of interest to MIW and ASW forces and SA of force protection against air, coastal missile, artillery and asymmetric attacks. Insight was also gained by redefining boundaries of operational warfare commanders and their co-location with the Joint Force Maritime Component Commander (JFMCC) and Surface Component Commander (SCC) onboard a flagship.

The operational "engine" for FBE Foxtrot execution centered on the complex requirements for Joint Maritime Access and Control (JMAC) in the Arabian Gulf. JMAC defines a capability for joint forces to conduct synchronous (vice serial) operations, using concurrent warfare concepts in ASW and MIW, coordinating joint assets in a maritime operation and enhancing multi-mission tasking. Central to all of these roles is the capability of the Joint Task Force (JTF) to respond to immediate threats and conduct synchronized operations, while simultaneously employing capabilities of a Joint Fires Element (JFE).

Data observers/analysts were responsible for coordinating the collection of data across multiple experiment themes (i.e. MIW, ASW, JFE, NBC, IO). The data collection team combined subject matter expertise with observations to capture immediate insights surfaced within the dynamic experiment environment. These insights included implications for organizing in a variety of various command conformations and some aspects of human factors involved in decision making. Each data collector provided a brief of daily impressions that were used to develop a general assessment for each experiment focal area.

Analysis in this complex experiment had many requirements for data collection. First was the requirement for data to be used in future study. Secondly observers noted events and data which were important to expanding notions of parallel operations within each of the primary experiment themes that had been defined as specific experimental questions. Thirdly, there were unintended consequences, or innovations that were unexpected but occurred as the experiment

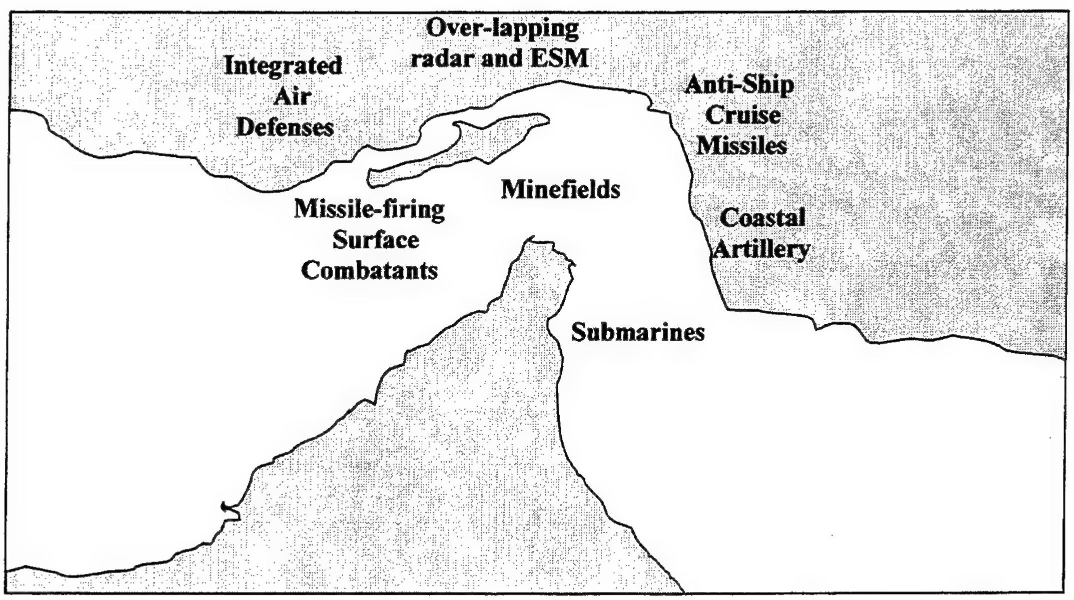
progressed. Collateral data, such as logs, communications and contextual material necessary to telling the "story" of FBE Foxtrot were also collected.

Experiment Theme

Joint Maritime Access Control (JMAC) was the central theme behind Fleet Battle Experiment Foxtrot. JMAC is that activity which assures Friendly Force access to littoral areas by neutralizing, destroying, temporarily degrading, or avoiding enemy maritime access denial systems and/or forces by any means.

The objective of JMAC is to enable joint military operations in the littoral which might otherwise be delayed, denied, or limited in effectiveness, or subjected to an unacceptable level of Friendly Force losses because of enemy maritime access denial. Access Assurance includes all

Challenging Chokepoint Denial Threats



methods that prevent or inhibit the enemy maritime access denial systems from accomplishing their mission. It includes methods that destroy, degrade, neutralize, or avoid enemy systems. The choice of operations method to apply in each situation is determined by enemy system characteristics and vulnerability.

The JMAC scenario developed for this experiment included an enemy closure of a critical maritime strait in order to prevent logistics shipping from getting through to support engaged land forces. In this situation, the critical operational issue was rapid opening of the strait to meet force objectives, and to sustain it open for sufficient duration to permit unimpeded transit of commercial and military shipping in support of the campaign. In order to achieve JMAC objectives, synchonized operations across various warfighting areas (i.e. MIW, ASW, Fires) were initiated. The experiment C4I architecture was configured to provide each Warfare Commander with the Common Operational Picture (COP) required to maintain complete

situational awareness of the battle-space as the events materialized. The ultimate objective was to reduce the timeline required to re-open the strait by having the individual warfare commanders take advantage of the COP thus allowing each to understand the battle space and proceed with the mission in their respective focus area in parallel fashion rather than with a more traditional sequential Concept of Operations (CONOP). Although the concept of conducting parallel vice sequential operations was the primary goal of the developed scenario, observations clearly illustrated, particularly in the MIW focus area, the vulnerability of this netted architecture and the significant impact it has when all assets do not have access to the COP. However, although the difficulty in maintaining robust, network centric connectivity degraded the situational awareness of certain MIW assets, a clearer definition of requirements needed to support organic MIW was examined and should result in a better understanding for future parallel operation experimentation.

A main aspect of FBE-F was to test a Strike Joint Fires Element. This system was tested in three phases.

Phase 1: In the Deterrence phase the S/JFE organizational role was to receive a Joint Prioritized Integrated Target List (JIPTL) that had been constructed in a collaborative process through a Joint Targeting Coordination Board (JTCB) and reprocess this Excel formatted information as weapons assigned to targets. This processing was conducted specifically at the JFE level, in a sub-element of the JFE, the JFE Strategy Cell (STRAT Cell). Here the initial weapon-target-pairing would take place, with "effects" considered, in order to make Effects-Based Orders to joint warfare commanders. The result of this process was that the Joint Maritime Component Commander (JMCC) and Joint Forces Land Component Commander (JFLCC) would use these directives to produce a coordinated Master Surface Fires Plan, and the JFACC would use the same data to produce a Master Air Attack Plan. Both master plans were then used to create an Integrated Tasking Order (ITO) which would coordinate deliberate Fires missions of all warfare commanders. Mission planning included weapons expected in this theater in 2005 included the Joint Direct Attack Munition (JDAM), Joint Stand Off Weapon (JSOW), Extended Range Gun Munition (ERGM), Land Attack Standard Missile (LASM), Tomahawk Land Attack Missile (TLAM) and its Tactical variant (TTLAM), the Army Tactical Missile System (ATACMS), HARM Block V and the Standoff Land Attack Missile-Extended Range (SLAM-ER).

Phase 2: The ITO developed deliberate planning described in Phase 1 (beginning with ITO A, and continuing in sequence to ITO E through the time frame of the experiment) began execution in concert with the parallel operations of Joint Maritime Assured Access and Control (JMAC). Organizational roles JFACC, S/JFE and warfare commanders increased in complexity as execution of ITO (Alpha) also required monitoring performance of execution while simultaneously planning ITO (Bravo) and conduct planning preparatory to operations in support of JMAC's mission to secure and open the Straits of Hormuz (SOH). Roles were distributed so that JFACC was responsible for coordinating USAF and USN tactical air missions, JFMCC coordinated precision guided munitions (ERGM, LASM and TTLAM) and the JFLCC was responsible for ATACMS (the JFLCC conducted its responsibilities from the Deep Operations Command Center (DOCC) in Kuwait). Other process responsibilities of S/JFE in this phase included the buildup of a digital fires network concurrent with and adapted to changes in operations such that the execution of Strike/Fires could be flexed across all platforms and

warfare components. An enhanced TLAM process, coordinated via a digital voice network was also employed in this phase, with TLAM inventory reports being fed back to the Strike Cell. Although airspace deconfliction is an obvious concern as aircraft and long-range precision weapons are deployed together through common airspace against ITO targets, real-time airspace deconfliction was not employed in the experiment. Instead, pre-planned strike missions were deconflicted through message traffic.

Phase 3: Phase 2 was a transition to offensive operations, which were then conducted in Phase 3 (the last 3 days of the experiment). System demands on S/JFE organization structure, processes and data flows increased to maximum levels of complexity. Concurrent with ITO planning which was still ongoing in the deliberate and sequential process, warfare commanders were conducting mine-hunting and clearing operations (MIW), ASW, special operations with Joint Special Operations forces and response to Time Critical Targets through processes within JFE.

In this phase a variety of organization relationships, command and control, ongoing deliberate planning, parallel operations by warfare commanders, targeting effects based upon CJTF guidance and adaptability in a time critical target environment were all combined in order to observe system reactions and adaptive capability. These interactions were of particular interest in the JFE, in the TCT rich environment.

B. JOINT EXPERIMENTATION – FBE-F OVERLAP MATRIX

Joint Experimentation - FBE-F Overlap Matrix

	EO 1					EO 3							EO 5						
	1	2	3	4	5	2	3	4	7	12	13	14	1	2	3	4	6	8	9
3.3.1.1		X	X	X	X														
3.3.1.2		X	X	X	X	X	X		X					X					
3.3.1.3		X	X	X	X	X	X		X					X					
3.3.2.1		X	X	X	X	X	X		X					X	X	X		X	
3.3.2.2		X	X	X	X	X	X		X					X	X	X		X	
3.3.2.3		X	X	X	X	X	X		X					X	X	X		X	
3.3.2.4			X			X								X					
3.3.2.5		X	X	X	X	X	X		X					X	X	X		X	
3.3.2.7			X													X			
3.3.2.8			X													X			
3.3.2.9			X													X			
3.3.2.10		X	X						X	X	X					X		X	
3.3.2.11		X	X						X	X	X					X		X	
3.3.2.12			X			X	X	X	X					X					
3.3.2.13			X			X	X	X	X					X					
3.3.2.14			X			X	X	X	X					X					
3.3.2.15			X			X	X	X	X					X					
3.3.2.16			X			X	X	X	X					X					
4.3.2.1		X									X	X							
4.3.2.2		X									X	X							
4.3.2.3										X		X							
4.3.2.4			X														X	X	
4.4.2.1		X						X		X	X								
4.4.2.2		X							X	X	X					X			
4.4.2.3									X										
5.2.1													X	X	X	X	X	X	X
5.2.2													X	X	X	X	X	X	X
5.3													X	X	X	X	X	X	X
5.3.1		X					X						X	X	X	X	X	X	X
6.0	X	X						X	X	X	X								
7.0	X	X				X	X	X											

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C. FBE-FOXTROT DATA CAPTURE ANNEX

APPENDIX E
DATA COLLECTION RESOURCE PACKAGE
FLEET BATTLE EXPERIMENT FOXTROT
30 Nov - 9 Dec 1999

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E1.0 INTRODUCTION

The purpose of this document is to provide data collectors with:

- A description of the overall process of developing Fleet Battle Experiments and how this process is connected to data definition and collection
- Some definition of the "systems" perspective important when multiple processes and systems are interacting together.
- What constitutes data and how data is connected to experimental concepts.
- Role of analysis, apart from but related to, data collection.
- Differences between data and knowledge.
- A short description of a high-level view of what FBE Foxtrot is about.
- How data collection is to be coordinated.
- Guidelines for collection activities and reports of collection.
- Statements of concepts being examined, and related questions of interest.
- General approaches to data collection within each concept area.
- A method for logging data.
- Specific subjective questionnaires for use in each data collection area.

E1.1 OVERVIEW OF FBE FOXTROT

The purpose of FBE-F is to improve combat readiness and interoperability of U.S. forces through application of future concepts, doctrine, and technologies in an existing USCINCENT CONPLAN. Specifically, FBE-F will focus on the future warfighting capabilities needed to execute the SLOC/ASLOC access mission requirements. FBE-F seeks to leverage Navy efforts to extend maritime dominance to a littoral environment. FBE-F hypothesizes that new warfighting concepts supported by technology will allow the Navy to enter and remain in the littorals indefinitely with the ability to provide intelligence, fires, Command and Control, logistics support, and protection of forces ashore. In particular, FBE-F will explore maritime dominance enabled by a common operational picture. This includes the undersea picture, force protection from air and coastal missile and artillery attack as well as asymmetric threats, and time critical targeting and precision engagement against a Third World country setting.

FBE Foxtrot is centered on the complex requirements for Joint Maritime Access and Control (JMAC) in the Arabian Gulf. JMAC must enhance the capability of joint forces to conduct parallel (vice serial) operations, use concurrent warfare concepts in the conduct of ASW and MIW, coordinate joint assets in a maritime operation and enhance multi-mission tasking. Central to all of these roles is the capability of the JTF to respond to immediate threats and conduct coordinated ('synchronized") operations, within a Joint Fires Element.

Data collectors will be assigned to various locations and will be responsible for coordinating the collection of data across multiple experiment themes. It is particularly important in this experiment that data collectors combine personal expertise with observations to define immediate insights within the dynamic experiment environment. Each data collector will be required to present a brief of daily impressions, insights and recommendations for additional

information/experiment execution. This report will be made daily at the end of experiment activity (approximately 1700).

E1.2 EXPERIMENT PROCESS

Fleet Battle Experiments result from a negotiation between the Navy Warfare Development Center (NWDC) (which has engaged in a process of concept development), the Maritime Battle Center (planning and execution of the experiment), Fleet Commanders (as the Warfighter and owner of unique theater challenges), high-level innovators engaged in developing the 21st century Navy, and technology developers and program managers (contract stakeholders). This is the short list. In actuality, there are many other people and organizations involved. All of these parties have some role in the development of the experiment, through the planning process and development of concepts. As with any complex plan, there are many compromises to the actual final experiment plan and its execution.

Capturing experiment data and results is similarly complex, both in concept, planning and execution. In planning, analysts have to become familiar with the dynamic conceptual terrain of the experiment. As an added challenge, it is necessary that as concepts are developed and coupled to experimentation, that there exist some correspondence between the intent of the experiment, the concept being considered in planning the experiment, and data collected in the conduct of the experiment. In general, this has meant that concepts have had to be re-defined as a set of questions, and that these derived questions have had to be retranslated to those elements of data which would suffice to expand "knowledge" about the question and therefore the concept being considered.

For this reason, it is important that data collectors understand the "conceptual terrain" of their respective observation areas, and the related questions. Data collection instruments (observation sheets, questionnaires, etc.) for each area are focused in this way.

Besides this concept-question-data instrument process, there are other very important data requirements. First, that the questions posed be refined through the experiment. That is, based on the conduct and results of the experiment, that questions surfaced as a result are captured for further exploration. Second, the role of innovation must not be neglected as a source of data. The data capture plan is a proposal about what might be important, based on what has been defined as relevant questions, and may be observed in what is thought to be the probable set of activities in the experiment. It is certainly possible that there will be a completely different set of activities, or "unexpected results," and these are often the most relevant and important results of an experiment. Data collectors and observers must be sensitive to these occurrences, noting them with as much explanation as possible.

As the experiment progresses and data continue to pile up, there is a general tendency to define the experiment in terms of the data, instead of the data in terms of the experiment. The intent of the FBE experiment process is ultimately to understand the "story" of what occurred in the experiment, in both a complex and a general way, and to use what is learned to further refine the concepts being considered as new FBEs are being planned.

E1.3 SYSTEMS METHODOLOGIES AND ANALYSIS

Analysis tests solutions. It doesn't create them. The mindset should be that strategists hypothesize better strategies, tacticians conceive better tactics, and engineers dream of better hardware; after which we analysts test the hypothesis that the strategy, tactic, or hardware is (in the appropriate sense) better. In operations research it's not "Let's analyze it so we understand it", but "Let's understand it so we can analyze it." Wayne Hughes, NPS.

"What we observe is not nature itself, but nature exposed to our method of questioning." Werner Heisenberg.

"According to the systems view, the essential properties of a (complex system) are properties of the whole, which none of the parts have. They arise from the interactions and relationships among the parts. These properties are destroyed when the system is dissected, either physically or theoretically, into isolated elements....The properties of the parts are not intrinsic properties, but can be understood only within the context of the larger whole

"Systems thinking is "contextual," which is the opposite of analytical thinking. Analysis means taking something apart in order to understand it; systems thinking means putting it into the context of the larger whole." Fritjof Capra

Analytic efforts have had four evolutionary steps. First, counting things in order to keep track of numbers of occurrences within any one category. Second, relationship between different categories of entities described by simple statistics (e.g., averages). Third, a relationship between numbers of things in different categories when uncertainty is involved (probability) and finally (present-day) efforts to understand relationship of different categories of things, in a dynamic environment. The first three steps are largely numerical and reductive, however the final one is either quantitative or qualitative.

Understanding a particular technology within a system usually means taking a measurement of something that the technology is supposed to do (cause and effect) and comparing that measurement against some standard of performance. This is generally a quantitative measurement, which makes sense, given its specific focus. However, when multiple technologies are combined in a "system," which may also include those "carbon-based technology units" (people), distinctions about the portion of which any one of those technologies contribute to the system become blurred and complex. This complexity increases further in a dynamic environment in which these relationships shift as the environment itself changes.

In complex experiments there is generally a continuum of data requirements related to differing objectives. For the technology manager with a specific program in the experiment, there may be a focused data requirement that is not concerned with relationships to other technologies. Concepts testing however, will likely include multiple technologies and systems. It is generally more difficult to make a single point data observation which adequately represents the system, although some performance may be inferred by a numerical measurement. For example, if the time to respond to a time critical target exceeds the dwell time of the target, this number represents a particular occurrence of system failure, yet tells the observer and analyst

very little about "why." In fact, both are important. The first to inform the observer of a potential problem within the system, and the latter to tell the "story" of the system in a way that is relevant to the research question being asked.

Analysis in the complex experiment also has a number of dimensions within a continuum. First, there is the collection of data for further study. In the process of data collection observers will note things which appear to be important with regard to the questions which are the basis for the experiment. A certain amount of inductive analysis takes place as the observer makes associations with what is happening. Secondly, apart from those data that are relevant within the context of known questions, there are occurrences which are not related to a question set, but which are nevertheless important. Innovations that are unexpected, but occur as the result of the dynamic within the experiment must also be noted. A third dimension includes collateral data, such as logs, communications and contextual material that one would want to have to tell the "story" about what happened in a complete and relevant manner.

E1.4 INFORMATION-BASED V. KNOWLEDGE-BASED DATA COLLECTION

Data collection and analysis in past FBE's have relied mostly on post-experiment integration and analysis. Some post-experiment analysis will continue (for example, in modeling and simulation and further development of explanation of specific experiment events). However, to the greatest extent possible the intent of the data collection and analysis effort in FBE Foxtrot will be to conduct as near real-time integration of data (information collected during the course of the experiment) as possible. Filling in the "story" of the experiment, in each area of concern, on a daily basis will provide a "knowledge" basis of the experiment for use in immediate reports of findings.

E2.0 GENERAL INFORMATION

E2.1 EXPERIMENT COORDINATION

There are multiple requirements for coordination of collection, assessment and reports throughout the experiment.

FBE Foxtrot includes three phases and parallel operations. Data will include context, which will change from day to day, dynamic interactions (results from interplay that is not scripted), and from a set of pre-scripted events that are close-hold within the red cell.

Collection coordination will be especially important as targets are injected via the F2C2, into the sensor domain, to which JFE and strike will have to respond. In order that such information as time sensed, action taken, weapons paired and target engaged times may be determined, data collectors will have to be forewarned with regard to these interactions. Some of these type of events will be planned in a daily planning process by experiment control, while others will occur as a result of immediate interactions which present an opportunity to stress the multiple systems being observed.

A controller circuit is proposed (voice) as one means to coordinate these type of interactions and provide an alert to collectors and other experiment control personnel. Local cell phones are another possible means for these communications, as well as a POTS line. E-mail, SIPR web communications etc will also be used. For each data collector the set of possible communications will be unique depending on the situation. It will be the responsibility of the data collection group or person at each site to maintain adequate contact with and stay abreast of the operations and activities that are the core of the experiment. Whether aboard ship, or ashore, it is absolutely essential to the success of this data collection effort that coordination be established and maintained throughout the experiment.

Coordination of collected data is a second requirement. At the end of each experiment day there will be some requirement to forward observations, assessment and feedback to the analysis coordination group. Use whatever means are available to do this, in a preference order of word data files, web files (formatted web site for data collection), e-mail, phone, sneaker net etc.

E2.2 OBSERVATION AND DATA REQUIREMENTS

Data collection is a demanding task. This task requires that data collectors observe what is important as defined in questions specified for each area, as well as what might be important because it is seen to be important to what occurs as the experiment unfolds.

In each section of this data collection package there is a set of questions that form a core of what has been defined as important within a specific area. Questionnaires, interview questions and electronic data are all important as the "evidence" from which an answer is proposed as "the" answer to any one of these core questions.

Data collectors for all of the areas of the experiment must do the following:

1) Define the context in which observations are made. For example, if the data collector was to note was to note something with regard to delays in Time Critical Targeting, it is important to note the delay, and the situation which was present at the time of the observation (e.g., prosecution of ITO targets, shift in commander's intent, changes to the organization for TCT, equipment/personnel problems etc.). This context is very important to understanding interactions in a complex way, but which may also be stated as the story of interactions.

   Part of the context is ground truth. This is especially important when a process (for example, targeting or ship position) is impacted by position. A second dimension to ground truth is time. Note time in all observations, as a way to track data (further explanation of data logging is found in section VII of this document).

   In addition to data that is collected through the data collector there is also data that is available through operational logs of different types, messages (e-mail included) and so forth. Not everything is relevant. Try to be specific in collecting documentation—it should help provide additional data to the observations the data collector is making, and the collector should be able to define why the information is important. Too much information can be as difficult an analytic problem as too little.

Use tape recording as a means to help you fill in notes later. This technique works better for some than others. However, recorders will be available for data collectors.

GPS recorders will also be available, and are recommended where unit track information is important for post experiment analysis. Some training is required for their use, and will be provided at the analysis briefing prior to STARTEX.

2) Note variances. What this means is that as the flow of a problem becomes more and more routine, note those instances which are not routine, or which cause the system being observed to behave in a different way.

3) Note changes in organization, and as well as you can, define reasons and consequences.

4) Besides the basic set of questions and data sheets provided to you, adapt data collection to what you are observing. That is, if we aren't asking the right questions, what are the correct ones?

5) Understand the system you are observing! Draw it out at the level you are observing it. Don't simply repeat the system from the EXPLAN, but try to construct it as a diagram based on what is actually happening.

6) Be familiar with the overarching data goals for the experiment, e.g., how is the timeline for parallel operations shortened with the organization being used in the experiment? Tying data directly to experiment questions will make the experiment a success, as long as these relationships are valid ones.

7) Do not interfere with the flow of operations, as they are ongoing. It is impossible to be a totally benign observer, however if it is important to know something by asking a participant, try to do this in a way that does not interfere. Post event interviews are an excellent way to obtain the "deckplate" view from participants, and you should try to do this. Use a recorder when you are doing this, and immediately transcribe the relevant portions into daily notes.

8) There is no way around this: Data collection is hard work. Some amount of preparation is required for each day's events. In addition it is extremely important to put observations in perspective and make assessments as closely to the event as practicable. Don't think you'll get to it back in CONUS. Even if you do, much will be lost.

E2.3 REPORTS

The data capture team is responsible for producing various reports throughout the FBE-F process. The following provides a general description of each:

1. Daily reports: The requirement here is for some general statement concerning outcomes of events occurring in each data collection area. The information is intended for possible inclusion in the daily FBE Foxtrot report, and to aid in writing of the end-of-action Quicklook Report.

2. Data reports: As each area of data collection builds a repository of information, this data needs to flow, as much as possible, daily to a central repository. As a practical matter, data needs to be collected into electronic form to the greatest extent possible and made available to the data collection coordinator and other analysts. The objective is to make as much of the data available to as many people as possible, as quickly as possible.

3. End of experiment report: Each data area will be required to describe a set of possible conclusions pointed to through the data. This "first cut" at data reduction and explanation is critical for further examination of the data. These reports will be made directly to IJWA (Dr. Gallup) for collection and integration in a first impression report based on the data.

4. Post experiment data working group: A meeting to discuss outcomes and explanations of data collection (from number 3 above) will be held at NWDC at the end of January (TBD).

5. Final Report: A final report will be delivered from IJWA to NWDC in March of 00.

E2.4 RESPONSIBILITIES

(Refer to Section E4.0 - Personnel Matrix)

3.0 CONCEPTS OF INTEREST

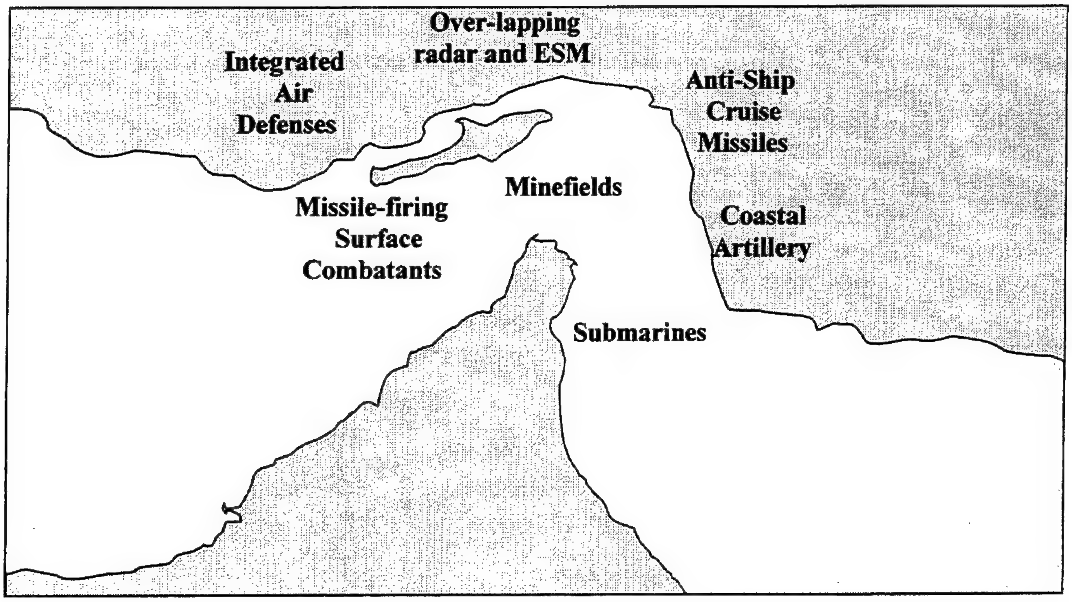
E3.1 JOINT MARITIME ACCESS CONTROL (JMAC)

E3.1.1 Concept

Joint Maritime Access Control (JMAC) is that activity which assures Friendly Force access to littoral areas by neutralizing, destroying, temporarily degrading, or avoiding enemy maritime access denial systems and/or forces by any means.

The objective of JMAC is to enable joint military operations in the littoral which might otherwise be delayed, denied, or limited in effectiveness, or subjected to an unacceptable level of Friendly Force losses because of enemy maritime access denial.

Challenging Chokepoint Denial Threats



An example of a JMAC operational situation would be the case of an enemy closure of a critical maritime strait in order to prevent logistics shipping from getting through to support engaged land forces. In this situation, the critical operational issue would be the opening of the strait in time to meet force objectives, and to sustain it open for sufficient duration to permit unimpeded transit of commercial and military shipping in support of the campaign. Joint Maritime Access Control requires some operations to take place prior to opening, operations to protect forces while opening the strait, and sustainment operations.

Access Assurance includes all methods that prevent or inhibit the enemy maritime access denial systems from accomplishing their mission. It includes methods that destroy, degrade, neutralize, or avoid enemy systems. The choice of operations method to apply in each situation is determined by enemy system characteristics and vulnerability.

E3.1.2 Relationship To Experiment

FBE Foxtrot is centered on the complex requirements for Joint Maritime Access and Control (JMAC) in the Arabian Gulf. JMAC must enhance the capability of joint forces to conduct parallel (vice serial) operations, use concurrent warfare concepts in the conduct of ASW and MIW, coordinate joint assets in a maritime operation and enhance multi-mission tasking.

E3.2 JOINT FIRES ELEMENT

E3.2.1 Concept

Central to execution of JMAC is the capability of the JTF to respond to immediate threats and conduct coordinated ('synchronized") operations, within a Joint Fires Element. The JFE is centralized, and will engage in all warfare areas outside of the Integrated Task Order (ITO) cycle. The JFE is also closely coupled within many C2 systems supporting a variety of sensors and weapons systems.

E3.2.1.1 Mission Concept

Provide C2 and technologies to perform target sensing to weapons pairing of time critical targets.

E3.2.1.2 Operations Method

Conduct of parallel operations within the Straits of Hormuz (SOH) using joint forces in a naval operation.

E3.2.1.3 Joint Fires Element (JFE) Objectives

The objectives for the JFE, distributed within three phases are the basis for data collection:

1. The development of a Joint Fires Element working directly for the JTF that will emphasize the use NSFS assets for deliberate and time critical targeting.
2. Enhanced Tomahawk Land Attack Missile (TLAM), Tactical Tomahawk Land Attack Missile (TTLAM), Extended Range Gun Munitions (ERGM), Land Attack Standard Missile (LASM) Joint Standoff Weapon (JSOW), Joint Direct Attack Munitions (JDAM) and Standoff Land Attack Missile Expanded Response (SLAM-ER) operations.
3. Ability to turn sensor events and products into aimpoints.
4. Establishment of a Joint Fires Network.
5. Localization, identification, and prosecution of TCT's.
6. Targeting of Weapons of Mass Destruction (WMD).
7. Improvements to the pre-planned targeting process.
8. Simulation-based excursions for future weapons and munitions.

The experiment will exercise the in theater architecture with theater organic and non-organic sensors.

- Exercise orchestrated sensor management and control

- Evaluate operation of a JFE TCT cell
- Evaluate impact of many-on-many pairing vice first in first out (FIFO) operations
- Perform and assess "on-demand" aimpoint generation
- Apply a broader suite of weapons against TCT's
- Evaluate advantages/disadvantages of unit level targeting.

The sensor management objective would address the following areas:

- Fusing sensor inputs in the C5F Strike Center
- Communications for sensor re-tasking.

E3.2.2 JFE Approach To Data Collection

Joint Fires encompasses nearly all other warfare and operational processes involved in the experiment. It also includes elements of deliberate (ITO) and time critical targeting, as well as being integral to interactions with other warfare areas.

The JFE is key to:

- Success of parallel vice serial operations
- Conduct of concurrent ASW/MIW operations
- Use of joint assets for maritime operations
- Effectiveness of multi-mission tasking

Shortening timelines, conduct of parallel processing of information, integration of an ITO (vice ATO), management of tactical imagery, target-weapons pairing (LAWS and JCSE), integration of fires and enhancement of TLAM/TTLAM operations are all impacted by the JFE.

Data collection in this area is obviously complex. Time is an important element in nearly all data collections in this area, especially as targets are identified as TCT's and response of processing, target pairing and fire missions are required to occur within the dwell time of the target.

Organization and processes of the JFE will be stressed in the experiment, to the point of possibly breaking down. It is critical for data collectors to understand the impact of operations on the JFE, and identify areas of sensitivity; in other words, what produces breakdown of the JFE system organization? As this occurs, how does the JFE respond in reorganizing itself to meet the operational challenge?

As the experiment progresses through each of the three phases data collectors for the Strike Center and JFE will maintain close contact and coordination with the F2C2 in order to conduct specific event-driven data collection. It is expected that data collection in this area will be nearly as dynamic as the system being observed, requiring extensive facilitation and post-experiment meetings daily to asses data collection and analysis efforts.

JFE Data collection will consider the following:

1. The ability of C3 to breakout TCT's from non-organic sensors and provide queuing to Joint Fires.
2. Use of TDA's to predict TCT operational areas of air assets to locate TCT's.
3. Ability of the sensor grid to locate deceptive targets and track during movement.
4. Ability of the sensing grid to provide data required of sensor-to-shooter and sensor-to-weapon linkages.
5. C3 capability with respect to maintenance of situational awareness.

Qualitative data will be collected in the form of questionnaires and observations. Quantitative data will be obtained from data logs, collaborative logs, system logs (e.g., LAWS/JCSE) and target time-stamps.

Primary Measure: Targeting process occurs within "dwell time" of target.

Supporting measures:

1. Number of targets appropriately sensed and this information was provided to the JFE.
2. Number of sensed targets determined to be hostile TCT by JFE process
3. Ratio of these targets assigned to weapons system
4. Ratio of targets destroyed within dwell time.

Diagnostic measures

1. Targets not sensed (investigate system failure)
2. Targets sensed but delayed in reporting to JFE (investigate system failure)
3. Targets sensed as hostile and not discriminated by JFE (investigate)
4. Situational Awareness factors
5. Targets not paired to appropriate weapons system (system failure, C2 failure)
6. Targets paired but not destroyed within dwell time (system failure, C2, LAWS, JCSE).

- What are points of system sensitivity?
- Under what conditions do data streams from sensor to shooter overload the JFE?
- Does the system degrade gracefully or self-organize in response to failures at system-sensitive points?

Time stamps:

1. When was a target sensed? Considered within "thread" processes (See Annex I - Data Logging Forms and Instructions)? Assigned to a shooter?

2. Time stamps related to GPS time? Autonomous GPS recording by NPS.

3. Simulated target event inject number must be associated with a track number used to "tag" information through JFE. JFE will not know that this is a data event. Electronic data collected through AARS (After Action Review System) will not be employed in this experiment. Coordination must be employed through OPFOR/Experiment Control, with data collectors. Independent events, across the range of TCT "threads" will be defined for each day's range of events.

Context:

1. Define for each event the tactical, C2 and organization context in which that event takes place. For example, that there are multiple targets being considered by the JFE at a particular time and the processes in use at that time. (Observation data)

2. Orange injects/ White Cell inputs
   - Observers and data collectors will need to know schedule for injects.
   - Coordination. Changes to event injects need to be communicated to observers.
   - Define dwell time for target event for later use in analysis

3. Ground truth
   - Part of experiment context.
   - GPS electronic logs where available.
   - ADSI for track data (needs to be turned on and data turned over--APC)
   - More important in later reconstruction and simulation efforts

3. System observations
   - System sensitivities. That is, points of system failure which degrade the JFE to where it is not clear that it can meet its goal of sensor-C2-shooter within target dwell time. (observations and participant questionnaires/interviews)
   - Collaborative logs; collated event logs and planing logs from JFE and ships

4. C2 and technology status
   - Distinctions, by event of sensor--system (target pairing etc)--shooter
   - Technology status is part of context
   - Description of architectures, as dynamic C2 "networks" (NPS Networks proposal) in NCW (Observations and network analysis).

5. Organizational change (self-organization of processes and C2)
   - Responses to change in the tactical environment
   - Responses to increase/decrease in ITO/TCT loading
   - Responses to failure modes

E3.2.3 JFE Questions of Interest

- Did the JFE perform sensing of targets (discriminating those of time critical significance within an environment of less time-sensitive targets), pairing of targets with suitable weapons systems, and oversee mission completion all within the TCT's "dwell" time?

- Did the JFE concept enhance the performance of parallel operations necessary to establish Joint Maritime Assured Access of the OPAREA?

- Is employment of a JFE an enhancement of concurrent ASW and MIW operations, as well as of multi-mission tasking (organic ASW/MIW)?

- What are the impacts of a JFE organization in coordination of Joint Assets for maritime operations? In a related question, what are the results of dynamic interactions between deliberate (ITO) planning and conduct of dynamic TCT missions?

- In what ways is the JFE organizationally sensitive to system conflict and degradation? Does the JFE have the capacity for dynamic self-organization in a time-sensitive environment?

- Did the decision-makers at LAWS/JCSE have enough data to make a reasonable decision (i.e. friendly force location, no hit targets, target surroundings for collateral damage assessments, WMD possibilities, etc.)?

- Did the use of GISRS-M in managing sensors help reduce the TCT prosecution time?

- What method was used to quickly and easily get information to higher authority, if required, and decisions of higher authority relayed back to the operators for execution?

- Did changes made to the TLAM process, specifically the use of MDS 4.X in planning and LAWS in dissemination and execution, improve the responsiveness of TLAM?

E3.2.4 JFE Data Collection Instruments:

See Section ANNEX I & II for the complete set of FBE-F Data Logging Forms and Subjective Observation Forms and Questionnaires

E3.3 MINE WARFARE

E3.3.1 MIW Concept

In order to assist the JFMCC and MIWC in executing their mission, FBE-F is attempting to highlight the effect of future capabilities and gain some insight into a mix makeup of organic and dedicated MCM forces in the 2005 timeframe. The foundation of the experiment is the tactical data link exchange between experimental mine countermeasures tactical systems (mainly through simulations), legacy mine countermeasures systems, and a command and control network to tie the two together. Through networking, display and management systems the following operational capabilities will be evaluated:

- Tactical data link capabilities to support timely exchange of MCM tactical information between the on-scene tactical commanders and assigned MCM forces.

- Automated MCM planning, evaluation and execution decisions support tools and automated information management and reporting capabilities interfaced with host platform core C4ISR capabilities.

Automated capabilities to develop, maintain and display a common MCM tactical picture, with the capability to integrate it with the rest of the maritime picture into the CJTF display. The MCM picture includes mine and mine-like contact locations, mine threat and danger areas, gaps in potentially mined areas, Q-routes, breakthrough and clearance status, and the location and status of MCM forces.

The objective of the MCM experiment is to exhibit a capability to conduct a seamless transition of MCM capabilities and responsibilities from in-theater forces to follow-on forces. The addition of future systems will incorporate capabilities to gain insight into MCM capabilities in the 2005 time frame and its impact on the CONPLAN timeline. Overarching considerations for the FBE-F MCM experiment are the fielding of efficient C4ISR capabilities to support the objectives of the FBE. The mix of legacy and new systems are tailored to provide a fused, integrated, almost real time MCM picture, timely situational awareness for the total force, and tailored MCM mission planning and evaluation tools for the MCM Warfighter as well as the Sea Combat Commander (SCC) and the JTF staff.

E3.3.2 Approach to data collection

MIW in FBE Foxtrot has several dimensions. First, structured analysis of MIW capabilities is being conducted by MIREM. Second, the experiment, apart from MIREM will explore the conduct of mine warfare as an organic operation, and in parallel with other warfare areas. The objective is to greatly reduce timelines for mine warfare as part of an overall JMAC initiative in the SOH. The implications for data gathering then, are that what is intended to be learned here relates to the use of new technologies (such as RMS and MEDAL) and procedures (organizing other warfare assets to become part of the mine warfare effort—organic MIW) within a timeline that includes other warfare operations. As the MIW experiment continues data collectors should note (as defined in the questionnaires provided in this document) those factors which contribute (positively or otherwise) to the conduct of MIW.

E3.3.3 MIW Questions of interest

Organizational

- How did the JFMCC/SCC/MIWC interface with each other and other warfare commanders for the tactical control of platforms with organic MCM capabilities?

- How did having organic MCM capabilities affect the Battle Group Commander's response in multiple threat situations and conflicting mission requirements?

- In a multi-threat situation, was the SCC, with the MCM mission assigned, able to effectively direct MCM forces, including organic MCM assets, clearly and with no ambiguity as to intent?

- To what extent did Warfare Commanders cooperate with the MIWC to support MIW mission when conflicting mission tasking requirements were present?

Architecture

- Do automated MCM planning, evaluation, and execution decision support tools provided sufficient support for Distributed Collaborative Planning (DCP) for the MIWC?

- Was the MEDAL/GCCS-M connectivity sufficiently robust to provide a near real-time Common Tactical Picture (CTP) between the MCM units and the SCC/JFMCC?

- Did the CTP provide sufficient situational awareness for the SCC to make knowledgeable tactical decisions based on mine threats depicted on the shared CTP?

- Was the MCM force able to maintain communications connectivity?

- How well did an integrated LINK/GCCS-M CTP support protection of MCM assets?

Environmental

- What was the impact of having in-situ environmental data on the concurrent MIW/ASW mission?

- Was NAVOCEANO SIPRNET connectivity sufficient to support expeditious transfer of environmental and bottom topography data exchange?

- Was the NAVOCEANO reach-back and quick turn-around of real-time data into data base support products tactically useful for forward-deployed MIW/ASW units?

Miscellaneous

- Was water-space management a consideration of the SCC to prevent mutual interference between MCM and ASW forces?

- Were air-space control measures sufficient to provide deconfliction between air MCM?

- Are the future MCM capable forces sufficient to effect a timeline reduction compared to today's capabilities in accomplishment of the SLOC clearance mission?

E3.3.4 MIW Data collection instruments

See Section ANNEX I & II for the complete set of FBE-F Data Logging Forms and Subjective Observation Forms and Questionnaires

E3.4 ANTI-SUBMARINE WARFARE

E3.4.1 ASW Concepts

The ASW objective during FBE-F will be to conduct and experiment as a building block for Distributed Collaborative Planning (DCP) between the MOCC, AIP P-3, and surface ships. FBE-F will explore the applications of DCP methodology to ASW search plans in support of coordinated multi-sensor ASW operations against submarine threats in the littorals. The experiment will examine methods of sharing a Common Tactical Picture (CTP) among all of the ASW forces. The CTP will include a common view of acoustic predictions based on high fidelity models, databases and in-situ environmental measurements. This effort will be run concurrent with SHARE 131 and Arabian Mace.

During the experiment, the Sea Combat Commander in conjunction with the ASW module will:

(6) Prepare plans to conduct parallel ASW and MIW
(7) Develop Netcentric approach to ASW
(8) Develop CTP aids
(9) Conduct distributive collaborative area ASW planning
(10) Examine underwater engagement zone (UEZ)
(11) Coordinate employment of coalition ASW assets.

FBE-F will focus on developing a search plan methodology where the goal of collaboration is to develop and maintain a force vice platform optimized search plan that provides the best utilization of available ASW resources to achieve campaign mission objectives. Characterization of DCP includes:

- Force vice platform level forces
- Shared operational situational awareness
- Synergistic employment of ASW force sensors
- In-situ measured and reach-back access to area environmental information

- Balanced processing and bandwidth
- Dispersed organizational structure

Exploration of CONOPS to develop and maintain a multi-sensor, coordinated ASW search plan using DCP to optimize area search under rapidly changing environmental and tactical conditions is also a primary ASW focus during the experiment. In addition, examining the use of advanced fusion techniques, shared high fidelity models and associated environmental data bases, and networked communications to increase situational awareness of the undersea battlespace will be a focal point of data collection.

E3.4.2 Approach to data collection

ASW in FBE Foxtrot will consist of analysis of ASW capabilities conducted by SHAREM. In addition to this formal and scripted evaluation the experiment will explore the conduct of ASW as an organic operation, and in parallel with other warfare areas. A principal area of investigation involves the use of collaborative tools to conduct planing for the execution of an ASW operation, using shared environmental data and with organic assets. As with the MIW experiment, the objective is to impact timelines as part of an overall JMAC initiative in the SOH. For data gathering then, what should be learned here relates to the use of collaborative technologies and procedures for sharing information in the conduct of planning and executing the ASW mission.

E3.4.3 ASW Questions of Interest

- Did the force optimized search plan developed via the Distributed Collaborative Planning (DCP) methodology yield a higher probability of detection (Pd) compared to the aggregated Pd of the independently developed platform search plans?

- Did the force optimized search plan developed via DCP methodology provide a greater sensor coverage for the volume of interest significantly minimizing or eliminating gaps that an adversary submarine could exploit?

- Did in-situ environmental data allow the SCC to develop and maintain a more accurate search plan (sensor lineup), and provide a greater confidence in implementation of the same plan developed with historical environmental data?

- Did the evaluation of time-series in-situ environmental data yield insight that permitted the SCC to further optimize the force integrated search plan to increase the Pd of the adversary submarine?

- Did Concurrent MIW and ASW operations reduce the time that would have been required if sequential operations had been conducted?

- Did Concurrent MIW and ASW operations subject the mine sweep assets to any higher ASW threat than sequential operations?

E3.4.4 ASW Data collection instruments

See Section ANNEX I & II for the complete set of FBE-F Data Logging Forms and Subjective Observation Forms and Questionnaires

E3.5 NUCLEAR, BIOLOGIC, CHEMICAL (NBC)

E3.5.1 Concept

An NBC Battle Management Cell will be integrated into FBE Foxtrot, and remain in place with equipment, organization and SOP's developed in the course of the experiment. "The goal at the end of FBE-F is an operational NBC cell for COMFIFTHFLT, capable of managing NBC Defense operations during peacetime and real-world operations."

E3.5.2 Approach to Data Collection

Data collection will be primarily qualitative, with observers at specific sites for data collection of NBC events (see NBC Data Matrix). NBC events will be integrated into the experiment. However, as a real-world NBC event would be expected to have the potential for interrupting all other operations, NBC in this experiment will be conducted within a sechedule of events and not become a block to the conduct of the rest of the experiment operations. Also, while many of the NBC objectives are very specific and may appear to be autnomous from much of the rest of the experiment, NBC management will cross most of the rest of the experiment objectives and operations to some degree. Data collectors must therefore be aware of NBC events, and their potential for interaction and inclusion in each of the other experiment areas. For this reason, NBC events and possible elements of data collection will be briefed to data collectors each day and coordinated with the NBC Battle Mangement Cell.

E3.5.3 Experiment Objectives and Questions

Objectives:

- Develop C2 architecture for effective NBC Management Cell
- Document SOP for NBC Management Cell
- Maintain a shared and accurate NBC tactical picture
- Define and provide NBC interfaces to provide uniterrupted information flow
- Assess NBC Analysis models for use in developing appropriate hazard areas from incident reports.
- Construct a dynamic inventory of personal and collective protection equipment, decontamination gear and medical supplies.

Questions:

- Does engagement of the threat benefit from networked multi-sensor surveillance and response forces in a layered defense?

- Evidence of this benefit within the NBC Battle Management Cell would consist of increased situational awareness using improved C2 for reachback, accessing threat developments with advanced sensors, and improved coordination of force protection.

- Is casualty management ashore enhanced using new tools for planning, event monitoring, clinical evaluation, clinical reference, patient stataus reporting, in-transit visibility, and information integration tools?

- Are civil-military opearations enhanced through the use of a NonCombatant management organization, including establishment of a virtual Joint Medical Center and Civil-Military Operations Center workspace?

- What are the limitations to using Counter-Proliferation Analysis and Planning System (CAPS) and Tactical Atmospheric Modeling System (TAMS) with the VLS plume evalutaion system as part of consequence management in a terrorist attack on petrochemical or chemical production facilities?

E3.5.4 NBC Data Collection Matrix (Draft)

Event name	Event description	Data required	Data type	Media	Locations	Location
Shipboard Bio	Release of internal contaminant onboard USS X.					NBC Cell
		BG Staff:				NBC Cell
		Time of recipt of notification	Observation	Notes	CV	NBC Cell
		Time Admiral was briefed	Observation	Notes	CV	NBC Cell
		Questions/orders issued	Observation	Notes	CV	NBC Cell
		Requests for information	Observation	Notes	CV	NBC Cell
		Actions taken onboard CV	Observation	Notes	CV	NBC Cell
		(mail, notifications, etc.)	Observation	Notes	CV	NBC Cell
						NBC Cell
Harbor dumping	Dumping of toxic chemicals observed by harbor patrol					NBC Cell
		Harbor area:				NBC Cell
		Units on patrol in harbor	Observation	Notes	CV	NBC Cell
		Actions taken by harbor security	Observation	Notes	CV	NBC Cell
		Who was notified	Observation	Notes	CV	NBC Cell
		When	Observation	Notes	CV	NBC Cell
		What information was passed	Observation	Notes	CV	NBC Cell
		Assessment by harbor on impact	Observation	Notes	CV	NBC Cell
						NBC Cell
Overwater contam.	Release of toxic cloud over water	Did ships in cloud react?	Observation	Notes	Ships	NBC Cell
		How did the ships react?	Observation	Notes	Ships	NBC Cell
		Who did they communicate with	Observation	Notes	Ships	NBC Cell
		What was their primary source	Observation	Notes	Ships	NBC Cell
		–for external information	Observation	Notes	Ships	NBC Cell

		–for internal information (DC?)	Observation	Notes	Ships	NBC Cell
		Were squadrons notified?	Observation	Notes		NBC Cell
		-- helo	Observation	Notes	Squadrons	NBC Cell
		-- MCM	Observation	Notes	Squadrons	NBC Cell
		-- Attack	Observation	Notes	Squadrons	
All NBC events	All events	When was notification received				NBC Cell
		What system was used				NBC Cell
		Did anyone refer to the web page				
		Did everyone know about the web page?				
		What NBC related messages were sent				

E3.6 INFORMATION OPERATIONS & C4I NETWORKS

E3.6.1 Concept

Of the FBE's instrumented for network data collection thus far, FBE-F will have the largest number of candidate users of shared media. This includes collaborative planning tools, web based intelligence services, and forwarded surveillance and targeting data from numerous experimental sources. The experiment will also include ASW, MIW, and Joint Fires components that will likely produce a distinct operational tempo not previously measured in the context of network bandwidth utilization.

FBE-F will also provide the opportunity to introduce new bandwidth management techniques, such as the use of network packet shapers. At the very least, this experiment will employ additional refinements to data reduction and analysis tools, facilitating improvements in the presentation of reported results during and pursuant to the conduct of an event.

E3.6.2 Approach to Data Collection

FBE-F has the potential to provide one of the most complex environments instrumented for network data collection to date. Moreover, it represents a change in focus form previous FBEs, with regard to network data collection. While collaborative planning, web-based chat tools, and various Land-Attack support tools will continue to be evaluated in this context, FBE-F is likely to rely much more heavily on web-based capabilities, than previous such evolutions. Thus, this event has the potential to provide an excellent opportunity for the observation of extensive web-based tactical applications within an exercise environment.

Network data collection will primarily be accomplished through the application of Notebook PC-hosted network analyzers. Network performance statistics will be collected through the use of network analyzers and specialized bandwidth management equipment. The network analyzers will be attached to key network "choke points", where significant FBE-F traffic is anticipated and restrictions in available bandwidth are evident through a review of network design. These network analyzers will generate network capture files, which will then be translated via an analysis program to a file format exportable to MS Office products. Captured network statistics will be mapped to significant operational events through the use of observers and network data collection operators. Observers will coordinate closely with exercise participants, logging events of interest and annotating those entries with time stamps. Observers will ensure this information is conveyed to network analyzer operators as quickly as possible in order to facilitate near real time analysis for significant events.

Other network performance statistics will be derived through the use of bandwidth management systems, capable of rendering periodic statistics as required to facilitate near real time monitoring in the field. These systems will provide clues as to the most productive areas (protocols, addresses, and applications) on which to focus subsequent data analysis effort. Moreover, these systems will also provide for the experimental use of bandwidth management

tools within the FBE environment, thus providing a potential means to optimize network bandwidth use for subsequent FBEs and ultimately Fleet operational use.

The network bandwidth management system tentatively selected for FBE-F is known as the "Packeteer", otherwise known as a packet shaping device. The Packeteer is designed to manage bandwidth through prioritization and by establishing a quality of service for subsystems that might otherwise be preempted by lower priority applications. Several distinct priority levels may be established, based on protocol, IP address, and application, rendering this tool a flexible potential solution for network centric warfare applications.

Collected network statistics and results of bandwidth management experiments will be rendered graphically and inserted into both quick look and final report formats for dissemination.

E3.6.3 IO Questions of Interest

(TBD)

E3.6.4 Instruments

See Section ANNEX I & II for the complete set of FBE-F Data Logging Forms and Subjective Observation Forms and Questionnaires

E3.7 PRIMARY TECHNOLOGIES

E3.7.1 Land Attack Warfare System (LAWS)

The Land Attack Warfare System (LAWS) will provide an integrated land and sea engagement grid for the timely engagement of fixed and Time Critical Targets (TCT's), fleeting surface maritime targets, and coastal defenses. The engagement grid will consist of PC-based workstations distributed ashore and afloat using SIPRNET and EHF communications. LAWS will interface to other systems such as JTSS, LPMP, GISRS-M, CAST, and GCCS-M, to receive situational data and target nominations.

LAWS is designed to increase situational awareness, automate processes for weapon-target pairing, automate airspace deconfliction, and automate coordination between joint forces engaging TCT's. FBE-F will provide the forum to evaluate LAWS to further determine how the system improves Fleet warfighting capability as it relates to TCT's.

E3.7.2 Joint Continuous Strike Environment (JCSE)

The Joint Continuous Strike Environment (JCSE) Advanced Concept Technology Demonstration (ACTD) offers the opportunity to enhance our capabilities to engage Time Sensitive Surface Targets (TSSTs). JCSE promises to leverage our considerable investments in C4ISR and weapons platforms by reducing the C2 timelines needed to develop Joint and Combined targeting recommendations in a JTF environment to attack time sensitive threats, thereby improving our probability to engage fleeting targets. JCSE will deliver this automated

decision and coordination aid that analyzes the status and priority of time sensitive targets across the battlespace, and recommends weapon target pairings, with a speed and robustness that greatly outperforms current manual and stovepipe processes for engaging time sensitive surface targets.

E3.7.2.1 Joint Targeting

Joint Force Commanders (JFC's) require common joint targeting procedures and a system to deconflict targeting operations, optimize target engagement, prevent duplication of effort, and reduce the potential for fratricide throughout the fluid, dynamic battlespace. This is especially true when joint force components have areas of operations that potentially overlap, as well as mutual interests and capabilities to strike targets of common interest. Each component has the ability to view the battlespace with a multitude of surveillance and reconnaissance assets (organic, joint, and national). While each component may be able to engage a detected TSST, the most effective weapon may only be available to another component. Safe and effective engagement of these dynamic targets will only be possible with effective cross component coordination.

E3.7.2.2 System Description

TSST's represent a class of highly mobile and stealthy operational nodes that operate within U.S. decision cycles. JCSE is predicated on the ability to shorten key decision cycle processes through automation to produce an integrated, information-based solution to rapidly target these elusive targets. The targeting capability is a function of the following modules:

Automated Target Prioritization (ATP): ATP takes guidance and continuously matches it with emerging targets as they are fed into the execution cycle from intelligence nodes to create near real-time target awareness by prioritizing potential targets in accordance with strategic guidance.

Continuous Weapon Availability Monitoring: JCSE's approach to automating this function involves tapping all of the weapon status feeds for a given platform.

Optimized Weapon Target Pairing: This JCSE function enables continuous opportunity based pairing by combining the output of Automated Target Prioritization and Continuous Weapon Availability Monitoring with identification and awareness of weapon/target dependencies using weapon system performance and threat behavior models.

Dynamic Airspace Deconfliction (DAD): DAD is a conflict resolution tool that interprets planned flight paths and airspace controls to determine existence and nature of airspace conflicts and provide possibilities for resolution.

E3.7.2.3 JCSE Relationship to FBE-F

Recent assessments suggest the number of time sensitive threats will be greater than the number of static threats in future conflicts. JCSE will provide a system with four modules to speed up the coordination and decision processes and allow time sensitive targets to be effectively engaged. Automated target planning, weapon system and munitions availability, target and weapons pairing, and airspace deconfliction have been integrated in JCSE to provide the JFC the key tool to coordinate and effectively engage time sensitive targets. FBE-F will provide the forum to further experiment with this capability.

E3.7.3 Remote Mine Hunting System (RMS)

RMS will provide surface combatants with a long endurance, low observable, off-board mine reconnaissance capability. RMS is an air-breathing, diesel-powered semi-submersible vehicle that deploys and recovers a variable depth sensor body from within the RMS hull. The system includes acoustic sensors for detecting, classifying, and localizing bottom, some close-tethered, and moored mines in the volume. The sensor body also includes an Electro-optic sensor for visual identification of mines. RMS is also equipped with forward-looking sonar (FLS), used primarily for obstacle avoidance. A mast-mounted video camera provides surveillance in support of surface contact avoidance.

During FBE-F the RMS capability will be a simulated asset that will be injected into GCCS-M via the Mine Warfare and Environmental Decision Aids Library (MEDAL) software segment. This simulation will provide the MIWC with an organic sensor that is capable of sampling the environment for sound velocity and bottom reverberation to optimize sensor performance in-situ. MIW simulations will be initiated and monitored from the Mobile Integrated Command Facility (MICFAC) but will be incorporated in the Common Operational Picture for the Sea Component Commander (SCC) and the MIWC to utilize during the decision making process.

E3.7.4 Mine Warfare and Environmental Decision Aids Library (MEDAL)

MEDAL is the integrated mission planning and evaluation tool for MIW forces. It is a software package that is integrated in the GCCS-M architecture to provide tactical MIW data management for the MIWC. The system permits automatic processing of contact and message data which allows operators to modify MCM plans in near real time. During FBE-F, the MEDAL segment will be utilized by all participating MIW assets and will provide the MIW COP. The results of this netcentric configuration and the MIW interaction with other parallel operations will be evaluated during FBE-F.

E3.7.5 PC Interactive Multi-sensor Analysis Trainer (PCIMAT)

PC Interactive Multi-sensor Analysis Trainer (PCIMAT) is a range dependant, acoustic modeling system that uses Navy Standard models and databases to predict and display the performance of sonar systems. It has the ability to exchange sonar predictions between ships and ASW Commanders. Data transfer using OPNOTES via OTCIXS to GCCS-M will be used to include updated ASW search plans into the Common Operational Picture (COP). This information will permit operators to conduct search coverage fusion and modify plots for force sensor planning. In addition, it has reachback capability to ingest MODAS fields and JJYY message format environmental data to assist in search planning efforts. PCIMAT will be tested in FBE-F as a tactical decision aids which should lead to cooperative engagement by the combatants. It will be integrated on the following FBE-F platforms: JFK, John Young, AIP P-3, and at the MOCC (Bahrain).

E3.7.6 Measure Interface Processor (MIP)

The MIP software can collect, process, and forward METOC data on the P-3 aircraft providing real-time in-situ METOC and acoustic information for personnel conducting ASW search planning. This data should enable critical and timely mission updates (i.e. performance predictions, etc.). System installations are planned for the AIP P-3 and the USS John Young and should provide the in-situ environmental data (temperature, noise) required to modify search plans. Data will be transmitted via UHF Line of Site (LOS) to participating assets.

E3.7.7 Cooperative Agents for Specific Tasks (CAST)

Cooperating Agents for Specific Tasks (CAST) is a DARPA funded R&D effort to apply cooperating intelligent agent technology to discover, correlate, and disseminate information from disparate, distributed data sources. A primary objective of CAST is to provide a system which will perform tasks on behalf of the operator with minimal intervention required from the operator. The operator provides a high level description of the required task and CAST launches agents to autonomously accomplish that task. The agents can persistently monitor distributed data sources for events of interest, combining and evaluating relevant data to alert the operator when such events occur.

Stand-alone versions of CAST technology were demonstrated in FBE-D and FBE-E. These demonstrations consisted of applying agents to discover possible Indications and Warnings (I&W) of missile launcher activity. The agents were tasked at a high level by an operator to look for this data in a specific geographic region (specified by rubber banding a graphic map display), after which CAST launched agents to local and off-ship data sources to attempt to discover relevant information. The operator merely expressed interest in a "region of interest", CAST identified the appropriate data sources, tasked agents to persistently monitor those data sources, tasked additional agents to collect and combine as appropriate information from agents monitoring those data sources, and ultimately alerted the user of discovered events. During these FBEs, CAST agents were working primarily against textual data from relational data bases, goals for Foxtrot and subsequent FBEs include using other data types, such as imagery, from other data sources.

CAST will focus on four specific areas during FBE-F under an overall objective of: "Applying Intelligent Agents to Provide an Intelligent Sensor to Shooter Link". The Foxtrot Fires Cell focus is on Imagery Based Targeting so the following CAST specific objectives focus primarily on improving imagery flow:

- Imagery Discovery and Dissemination

Based on target nomination requests, CAST will send agents to discover and disseminate applicable imagery on the nominated targets. CAST agents will disseminate those imagery files in the required format (NITF or commercial) to appropriate systems (PTW+, CAST console). This would alleviate the operator of having to ftp to multiple sources and manually search those sources.

- Sensor Cueing

CAST will identify sensor cueing requirements based on target nominations. CAST will send agents to persistently monitor target nomination and Call for Fire (CFF) requests. Especially in situations where a target nomination is not answered by a CFF (which may indicate an un-assignable target - insufficient information, moving target...), CAST agents will attempt to obtain additional sensor information or send sensor cueing requests to attempt to resolve the target. This would alleviate the targeting officer from having to manually identify sensor data and requirements and subsequently generate sensor cueing requests. An operator could also initiate the requests by tasking CAST to send agents to retrieve sensor data or cue sensors as appropriate.

- Imagery BDA

Subsequent to launches against a target, CAST agents will discover and retrieve relevant imagery on those locations to assist in BDA determination. CAST will monitor CFF requests and subsequently send agents to identify and retrieve imagery from applicable sources.

- BDA from Other Sources

Subsequent to firing upon a target, apply CAST agents to discover possible BDA I&W from data sources which are not traditionally monitored for BDA.

An overarching objective is to provide a tool, which will require minimal operator involvement to launch the agents to identify, required information. CAST will monitor ongoing message traffic (eg. A target nomination via USMTF ATI.ATR messages, fire requests via Call for Fire messages). After the agents identify pertinent information, they will either take it to the required location and/or alert the
Operator as to the existence of the information.

E3.7.8 TARPS-CD

(TBD)

E3.7.9 PTW+

PTW+ is an integrated suite of applications that uses client-server technology (SUN server, PC client) to support the collaborative targeting process. The system is designed to improve the warfighting capability of the Fleet staff and/or subordinate platforms. PTW+ uses the AIP-P3 imagery to generate an aimpoint that is fed into JCSE and LAWS. JCSE and LAWS performs weapon target pairing for the initial target location and the subsequent PTW+ supplied aimpoint is integrated to isolate the target. This system should expedite and improve the C3 process for the development and execution of Time Critical Targets (TCT's) and it will be evaluated in that capacity during FBE-F.

E3.6.9 Global ISR System - Maritime (GISRS-M)

(TBD)

E4.0 PERSONNEL

E4.1 Data Capture Personnel Contact Information

Last Name	First Name	Rank	Assignment	Location	From	Purpose	e-mail	Phone #
Gallup	Shelley	GS-15	Exp Control	Bahrain	IJWA/NPS	Analysis Coordination	spgallup@nps.navy.mil	831-656-104
Kindig	Barry	CIV	FL	Bahrain	SSC-SD	Network Analysis	Kindig@drs-tsi.com	619-299-321
Kimmel	Richard	CIV	ASW/MIW/JFE/IO	FBE Central	IJWA/SPAWAR	Data Collection	rakimmel@nps.navy.mil	831-656-229
Moose	Paul	CIV	ASW/Network Archit	Bahrain	IJWA/NPS	Data Collection	phmoose@nps.navy.mil	
Balaconis	Roy	CIV	Joint Fires Element	JFE	MBC	Data Collection	rbalaconis@jaycor.com	757-460-861
La Varre	Andy	CIV	Command Relations	Bahrain	NWDC	Data Collection	lavarrea@nwc.navy.mil	401-845-681
Etzl	Julius	GS-13	JFE/CAST	JFE	LMATL	CAST Data	jetzl@atl.lmco.com	
Wazlavek	Linda	GS-13	MIW Simulation	MICFAC	CSS	MIW data collection	wazlaveklg@ncsc.navy.mil	850-234-490
Leahy	Michael	CIV	MIW Data Capture	MICFAC	IJWA/Boeing	MIW data collection	michael.j.leahey@boeing.com	
Callahan	Alex	GS-15	Joint Fires Element	JFE	IJWA/NPS	JFE Data Collection	callahan@nps.navy.mil	831-656-222
Bowden	John	GM-13	Joint Fires Element	JFE	IJWA/CRANE	JFE Data Collection	Bowden_John@crane.navy.mil	
Midgette	Keith	CIV	MIW	DEXTROUS	NWDC	MIW data collection	midgettk@nwdc-nor.navy.mil	
Schmitt	Paul	CIV	ASW	JFK	NWDC-MBC	ASW data collection	schmittp@nwc.navy.mil	
Kemple	Bill	GS-15	JFE	JFK	IJWA/NPS	JFE Data Collection	kemple@nps.navy.mil	831-656-330
Gissendanner	James	CIV	JFE/MIW	JFK	IJWA/Boeing	JFE Data Collection	James.GissendannerJ@HSV.Boeing.com	
Gillespie	John	GS-12	ASW/MIW/JFE	JFK	IJWA/CRANE	JFE Data Collection	Gillespie_John@crane.navy.mil	
Brzegowy	Michael	GS-12	ASW/MIW/JFE	JPJ	IJWA/CRANE	Data Collection	Brzegowy_M@crane.navy.mil	
Hunter	Dave	LCDR	JFE/ASW/MIW	JY	Naval Reserve	Data Collection	dhunter@pa.dec.com	650 617 3594
James	Paul	CDR	JFE	EXETER	MBC	JFE Data Collection	jamesl@nwc.navy.mil	401-841-417
Ray	Karen	GS-15	MIW	MICFAC	ONR	MIW data collection	nsapc6f@nosc.mil	

E4.2 On-Site POC and Contact Information

(TBD)

E5.0 EXPERIMENT TOPOGRAPHY

Data Collectors are responsible for obtaining architecture diagrams for the following relevant FBE spaces:

- Bahrain
- C5F Strike Cell
- JOC
- F2C2
- MICFAC
- USS John F. Kennedy
- USS John Paul Jones
- USS John Young
- USS Dextrous
- MOCC

ANNEX I Data Logging Forms & Instructions

System Overview

The data you will be logging focuses on

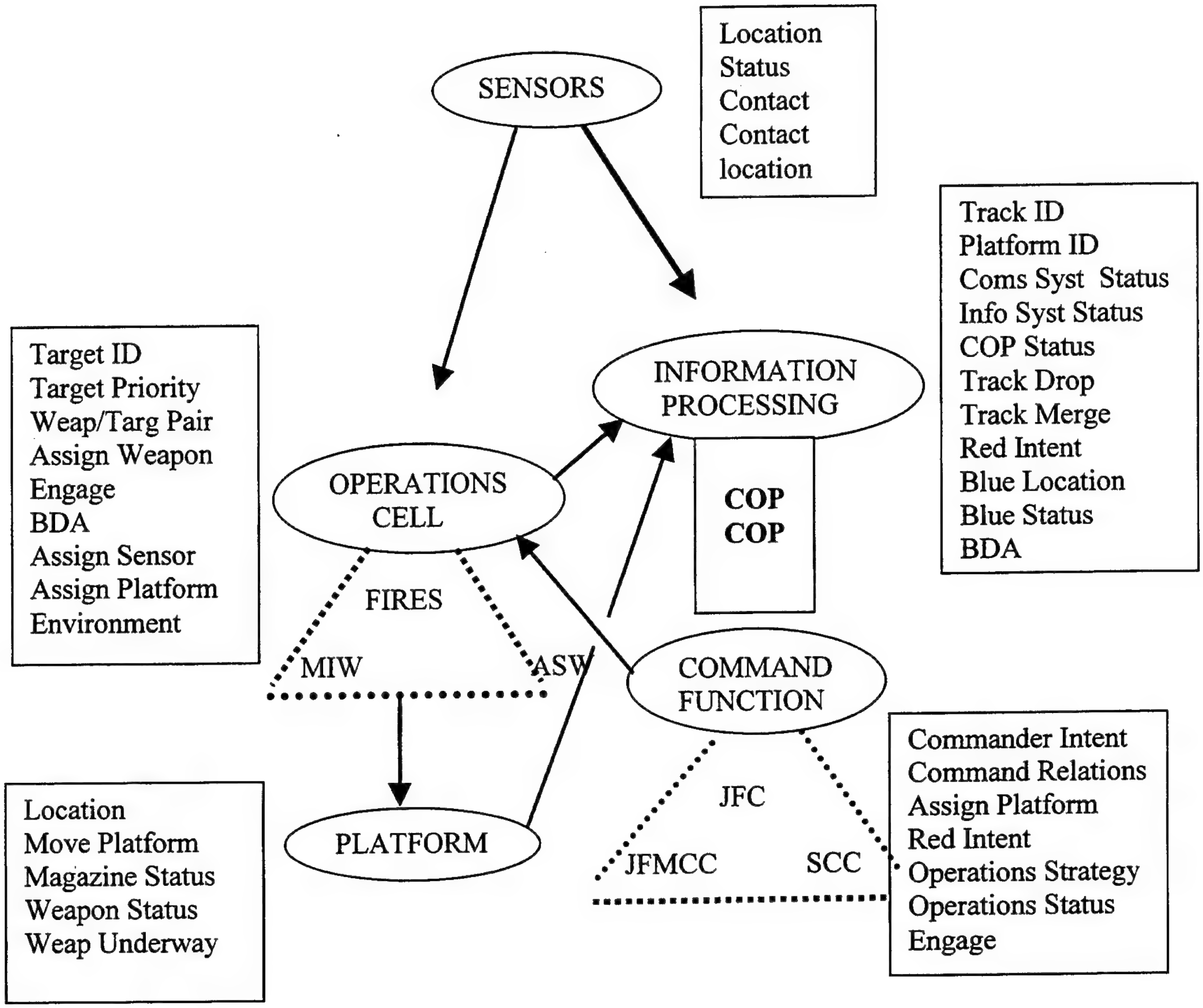
detection	reporting
information development	decision making
information transmission	physical actions

Our main purpose is to track information flow, the decisions that are made based on that information, and the physical actions which result. We wish to log the times at which these activities occur, which requires that you supply narrative observations about pertinent events, the times at which they occur, and check a box that we use to enter the data into a relational data base.

We have a limited number of data loggers for FBE-F, which means that we can only log events which occur at a fairly high level in the operations system, not all of the details which occur throughout the system. In order to track information at this level and to match the data logging structure to the system, we segment the operations system into sensors and three types of organizations, shown below. The data logging forms you will use are matched to this segmentation.

Information processing and the creation and dissemination of a Common Operations Picture (COP) is an important, even crucial, part of Netcentric operations. We wish to keep track of this process. You will note that we assume that this information processing is associated with the command functions. We presume that those logging command functions will also be logging information-processing activities.

Each organization has several types of information associated with it, also shown below, which they develop for internal purposes and to send to other organizations. Of course, they also receive information from other organizations, but in the diagram we associate that information with the originating organization. You will record when information is developed, sent, and received, and when decisions are made. In the case of those platforms, which take physical actions (even if simulated), such as weapon launching, you will log the occurrence of those actions.


SENSORS
Location
Status
Contact
Contact
location
Track ID
Platform ID
Coms Syst Status
Info Syst Status
COP Status
Track Drop
Track Merge
Red Intent
Blue Location
Blue Status
BDA
Target ID
Target Priority
Weap/Targ Pair
Assign Weapon
Engage
BDA
Assign Sensor
Assign Platform
Environment
INFORMATION
PROCESSING
OPERATIONS
CELL
COP
COP
FIRES
MIW
ASW
COMMAND
FUNCTION
JFC
JFMCC
SCC
Commander Intent
Command Relations
Assign Platform
Red Intent
Operations Strategy
Operations Status
Engage
PLATFORM
Location
Move Platform
Magazine Status
Weapon Status
Weap Underway

Data Logging Forms

The purpose of the following forms is to capture the times at which events occur. We need your description of the event, such as "tomahawk underway", or "target identified", or "sensor contact received". Your description of the event is entered in the "Observation" column. Following that several columns that are to be checked to note the type of event, system information, etc.

As an example of how this logging scheme is used, consider the launching of a weapon at a target. The following set of data entries could be recorded (among others associated with the event):

Command center 1500 Transmit command to attack TEL with Tomahawk
The track/target ID and the Platform ID would be entered,
Check the boxes Info Sent Assign Platform Engage
Platform 1505 Received command to attack TEL
The target ID would be entered
Check the boxes Info Received

Platform 1515 Launched Tomahawk at TEL
The target ID and the Weapon/launch tube ID would be entered
Check the boxes Engage

Fires Cell 1520 Sensor report on TEL strike
The target ID and the sensor ID would be entered
Check the boxes Info Received

Fires Cell 1522 BDA on TEL shows not destroyed
The target ID would be entered
Check the boxes Info Developed BDA

Note that with a complete set of boxes of this type checked at all the locations which were involved with this target, it is possible to pull a "thread" through the archived data and reconstruct the full sensing through engagement sequence. This is the purpose of this system of data logging.

The following are the data logging sheets and the explanations that accompany each.

Operations Cell (Fires, ASW, MIW)
Only the data logging form and codes for one cell is shown as all three are the same.
Time time at which an event occurs
Observation short narrative of the event being recorded
Track ID identification of the red or blue track
Plat ID identification of the platform assigned a mission or communicated with, or the command center from which instruction is received
Sens ID identification of the sensor from which a report is obtained

INFORMATION

Dev	information developed within the cell
Rec	information received
Sent	information sent
Targ ID	target identified (or lack of ID of injected target)
Targ Pri	target assigned a priority
Weap Targ	weapon type-target pairing assigned for effects
Assn Weap	specific weapon assigned to a target
Eng	decision to engage a target
BDA	battle damage assessment performed
Assn Sens	assign a sensor to an area or a target
Assn Plat	assign a platform to carry out an action
Env	environmental information
Srch Plan	search plan established or enacted
Targ Inj	injection of simulated target into the information system
Othr	indicate at column top the designation you are using

Command Center (JFC, JFMCC, SCC)

Only the data logging form and codes for one cell is shown as all three are the same.

Time	time at which an event occurs
Observation	short narrative of the event being recorded
Track ID	identification of the red or blue track
Plat ID	identification of the platform assigned a mission or communicated with, or the command center from which instruction is received

INFORMATION

Dev	information developed within the cell
Rec	information received
Sent	information sent
Cmdr Int	commander's intent
Cmnd Rel	command relationship
Assn Plat	assign a platform to carry out an action
Red Int	red forces intent, including projected impact of an attack or weapon
Ops Strat	current operations strategy
Ops Stat	current state of operations
Eng	engage a target
Other	indicate at column top the designation you are using

Common Operations Picture (information processed in the command center)

Time	time at which an event occurs
Observation	short narrative of the event being recorded
Track ID	identification of the red or blue track
Plat ID	identification of the platform assigned a mission or communicated with, or the command center from which instruction is received

INFORMATION

Dev	information developed within the cell

Rec	information received
Sent	information sent
Coms Stat	status of the communications system
Syst Stat	status of the information system
COP Stat	status of the Common Operations Picture
Trk ID	identification of a track
Trk Drop	track lost or dropped from the COP
Trk Merg	tracks merged and ID confusion
Red Int	red forces intent
Blue Loc	location of a Blue platform
Blue Stat	status of Blue forces or platform
BDA	battle damage assessment
Other	indicate at column top the designation you are using

Platform

This data logging sheet and instructions applies to all platforms that are responsible for actions such as launching weapons, deploying forces, etc.

Time	time at which an event occurs
Observation	short narrative of the event being recorded
Track ID	identification of the red or blue track
Plat ID	identification of the platform assigned a mission or communicated with, or the command center from which instruction is received

INFORMATION

Dev	information developed within the cell
Rec	information received
Sent	information sent
Loc	location
Move Plat	move platform
Mag Stat	status of a weapon magazine
Weap Stat	readiness status of a weapon or weapon system
Weap Unwy	weapon is underway to the target
Forc Lnch	forces launched
Targ Acq	acquisition of or tracking target

THE FOLLOWING PAGE IS AN EXAMPLE DATA-LOGGING FORM

FBE-F Data Logging Sheet (FBE-data-Fires)

FIRES CELL DATA

Specific Location ________________ Data Logger________ MESL _____ Date _______

Comments:

					INFORMATION			Weapon & Target Actions										
Time	Observation (action, info source, weapon, etc)	Track ID	Plat ID	Sens ID	Dev	Rec	Sent	Targ ID	Targ Pri	Weap Targ	Assn Weap	Eng	BDA	Assn Sens	Assn Plat	Env	Srch Plan	Targ Inj

NAVAL POSTGRADUATE SCHOOL
INSTITUTE FOR JOINT WARFARE ANALYSIS
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C. ANNEX II

OBSERVER AND PARTICIPANT

QUESTIONNAIRES & FORMS

Subjective Observation Forms

During an event of a Fleet Battle Experiment, there are a large number of activities occurring simultaneously and the challenge is to capture that information which adequately enables the desired analyses. Subjective information, people's observations, are an important part of this information. The following forms are used to capture these observations.

These forms alert the observers to the types of information desired. We wish to have the information requested supplied, but do not expect that the forms include all worthwhile observations that you might make. Thus, we encourage you to supply any additional observations you feel will be pertinent to the experiments objectives.

IN ORDER TO SAVE SPACE IN THIS REPORT, THE FOLLOWING FORMS ARE ABBREVIATED. E.G. THE DIRECTIONS AND OTHER GENERAL DATA WHICH HEAD EACH FORM ARE ONLY SHOWN IMMEDIATELY BELOW. THEN THE SPECIFIC QUESTIONS FOR EACH LOCATION ARE SHOWN.

FLEET BATTLE EXPERIMENT FOXTROT

EVENT____________

DATA COLLECTION SHEET

(to be completed by the data collector during and after the event)

Date: ________________ *Data Collector:*____________

Unit/Platform: ASW Module

	Start Event	*End Event*
Time (Zulu):		

General Instructions:

1. *Complete the Data Logging Forms.*
2. *Distribute Questionnaires to key participants in your cell.*
3. Where possible, obtain copies of communications, activity, nav, etc. logs.
4. *Complete the Environmental Data Form.*
5. *Record any comments/observations you think are relevant.*

Unit/Platform: ASW Module

Specific questions:

1. Were the Data Logging Forms and Questionnaires successfully completed so this event is adequately captured? If not completely successful, to what degree were you successful and what problems were encountered?
   (THIS QUESTION IS #1 ON EACH FORM AND WILL NOT BE REPEATED)

2. Did the use of PCIMAT benefit ASW operations? If so how, if not why?

3. Did communications links meet the needs of ASW DCP?

4. How did the concurrency of fire missions impact ASW operations?

5. How did the concurrency of MIW missions impact ASW operations?

6. How did the availability of in-situ environmental data impact ASW operations?

7. Will ASW DCP lead to a higher probability of target detection than conventional procedures?

8. Were the search plans generated by the ASW module produced in a timely manner and take full advantage of shared data?

9. How effectively does the ASW module communicate with the SCC?

10. How effectively does the ASW module communicate with the MIWC?

11. How effectively did the ASW module exercise CC over ASW assets?

12. Was manning adequate?

Unit/Platform: MIW Module

Specific questions:

1. What was the impact of DCP on MIW operations?

2. Did communications links meet the needs of MIW DCP?

3. Was the performance of MEDAL acceptable? If not, why not?

4. How did the availability of in-situ environmental data impact MIW operations?

5. Does MIW DCP lead to a higher probability of target detection than conventional procedures?

6. Were the search plans generated by the MIW module produced in a timely manner and did they take full advantage of shared data?

7. How did the concurrency of fire missions impact the MIW mission?

8. How did the concurrency of ASW missions impact the MIW mission?

9. What was the impact of organic MCM on the allocation of MCM assets?

10. Does the existence of a MIWC positively affect MCM relationships between MCM assets and other warfare commanders?

11. How effectively did the MIW module communicate with the MIWC?

12. How effectively did the MIW module exercise CC over MCM assets?

13. Does the existence of a MIWC positively affect the response time to MCM tasks presented by subordinate units?

14. To what extent did warfare commanders cooperate with the MIWC to support MIW missions when conflicting mission tasking requirements were present?

15. Was the MIW module adequately staffed?

16. Is the reach back response time to NAVOCEANO acceptable?

17. Were the NAVOCEANO data tactically useful?

18. How well did an integrated LINK/GCCS-M picture support protection of MCM assets?

Unit/Platform: JFE

<u>Specific questions:</u>

1. What was the impact of DCP on JFE operations?

2. Did the JFE perform sensing of targets (discriminating those of time critical significance within an environment of less time-sensitive targets), pairing of targets with suitable weapons systems, and oversee mission completion all within the TCT's "dwell" time?

3. Did the JFE concept enhance the performance of parallel operations necessary to establish Joint Maritime Assured Access of the OPAREA?

4. Is employment of a JFE an enhancement of concurrent ASW and MIW operations, as well as of multi-mission tasking (organic ASW/MIW)?

5. What are the impacts of a JFE organization in coordination of Joint Assets for maritime operations? In a related question, what are the results of dynamic interactions between deliberate (ITO) planning and conduct of dynamic TCT missions?

6. In what ways is the JFE organizationally sensitive to system conflict and degradation? Does the JFE have the capacity for dynamic self-organization in a time-sensitive environment?

7. Was the JFE able to effectively communicate with higher authority when necessary?

9. Did the decision-makers at LAWS/JCSE have enough data to make a reasonable decision (i.e. friendly force location, no hit targets, target surroundings for collateral damage assessments, WMD possibilities, etc.)?

10. What method was used to quickly and easily get information to higher authority, if required, and decisions of higher authority relayed back to the operators for execution?

11. Did changes made to the TLAM process, specifically the use of MDS 4.X in planning and LAWS in dissemination and execution, improve the responsiveness of TLAM?

12. Did the Joint Fires Network perform satisfactorily? If not, in what ways was it inadequate?

13. Did communication links meet the needs of the Joint Fires Network?

14. Are TCTs serviced within their dwell times? If not, which step, or steps, in the targeting process were problems?

15. Were specific weapon systems a problem in delivering timely fire?

16. Were specific target types a problem in delivering timely fires?

17. Compare the fire-target pairings produced by LAWS and JCSE.

Unit/Platform: John F. Kennedy

Specific Questions:

ASW questions:

1. What was the impact of DCP on ASW operations?

2. Did communications links meet the needs of ASW DCP?

3. How did the concurrency of fire missions affect the ASW mission?

4. How did the concurrency of MIW missions affect the ASW mission?

5. How effectively does the ASW module communicate with the SCC?

6. How effectively does the SCC communicate updated ASW planning to the MIWC?

7. Was manning adequate?

MIW questions:

1. Does the existence of a MIWC positively affect MCM relationships between MCM assets and other warfare commanders?

2. Does the existence of a MIWC positively affect the response time to MCM tasks presented by subordinate units?

3. To what extent did warfare commanders cooperate with the MIWC to support MIW missions when conflicting mission tasking requirements were present?

4. How effectively did the MIWC communicate with the MIW module?

5. How effectively did the MIWC communicate with the SCC?

6. How effectively did the MIWC module exercise CC over MCM assets?

7. Were the MIWC and SCC adequately staffed to support MIW?

8. What was the impact of organic MCM on the allocation of MCM assets?

9. What was the impact of DCP on MIW operations?

10. Was the performance of MEDAL acceptable? If not, why not?

11. Did communication links meet the needs of MIW DCP?

12. How did the availability of in-situ environmental data impact the MIW mission?

13. Is the reach back response time to NAVOCEANO acceptable?

14. Were the NAVOCEANO data tactically useful?

15. How well did an integrated LINK/GCCS-M picture support protection of MCM assets?

16. Was waterscape management a consideration of the SCC to prevent interference between MCM and ASW forces?

17. Were airspace control measures sufficient to provide deconfliction between AMCM and other air assets?

Joint Fires questions:
1. What was the impact of DCP on strike operations?

2. Did the Joint Fires Network perform satisfactorily? If not, in what ways was it inadequate?

3. Did communication links meet the needs of the Joint Fires Network?

4. How effectively was unit level weaponeering performed?

5. What was the interval between receipt of tasking and aircraft launch?

Unit/Platform: USS John Paul Jones

Specific Questions:

ASW questions:
1. How did the concurrency of fire missions impact the ASW mission?

2. How did the concurrency of MIW operations impact the ASW mission?

MIW questions:
1. How did the concurrency of ASW operations impact the MIW mission?

2. How did concurrency of fire missions impact the MIW mission?

3. How well did the crew handle organic MCM operations?

4. Was manning adequate?

5. Evaluate the impact of the RMS on MIW operations.
6. What was the impact of DCP on MIW operations?

7. Did communication links meet the needs of MIW DCP?

8. Evaluate the impact of MEDAL on MIW operations.

9. How did the availability of in-situ environmental data impact MIW operations?

Joint Fires questions:
1. What was the impact of DCP on strike operations?

2. Did the Joint Fires Network perform satisfactorily? If not, in what ways was it inadequate?

3. Did communication links meet the needs of the Joint Fires Network?

4. How did the concurrency of ASW operations impact fire missions?

5. How did the concurrency of MIW operations impact fire mission?

6. How effectively was unit level weaponeering performed?

7. What was the interval between receipt of tasking and weapon fire?

Unit/Platform: John Young

Specific Questions:

ASW questions:

1. What was the impact of DCP on ASW operations?

2. Did the use of PCIMAT benefit ASW operations? If so how, if not why?

3. Did communications links meet the needs of ASW DCP?

4. How did the concurrency of fire missions affect the ASW mission?

5. How did the concurrency of MIW missions affect the ASW mission?

6. Was manning adequate?

Joint Fires questions:

1. What was the impact of DCP on strike operations?
2. Did the Joint Fires Network perform satisfactorily? If not, in what ways was it inadequate?

3. Did communication links meet the needs of the Joint Fires Network?

4. How did the concurrency of ASW operations impact fire missions?

5. How effectively was unit level weaponeering performed?

6. What was the interval between receipt of tasking and weapon fire?

BATTLE EXPERIMENT FOXTROT
EVENT: ______

QUESTIONNAIRE
(to be completed by participants, post event)

*Date:*______________ *Data Collector:*___________

Unit/Platform: ________ *Name of Subject:*______________ *Duty of Subject:*___________

Where appropriate, questions may be answered with a numerical value in the range of 1 to 10 with 1 being poor and 10 being outstanding.

1. What DCP tools did you use?

2. How effective were these tools? What problems if any did you experience?

3. What were the impacts of DCP on the operations and effectiveness of your cell?

4. Did communications links meet the needs of DCP?

5. Did your cell have timely and adequate data to properly conduct its operations? If not, what were the specific deficiencies?

6. How did the concurrency of operations affect the operation of your cell?

7. Did your cell function well? If not why not?

8. Was the manning level in your cell adequate? If not, how many and where were additional personnel required?

9. Which other cells did you communicate with? Were communications easily established? If not, what were the specific problems?

10. Were the cells with which you communicated responsive? If not, what specific problems were encountered?

11. What is your perception of what worked well in this event?

12. How could this event be improved?

13. Additional Comments.

FLEET BATTLE EXPERIMENT FOXTROT

Event: _______ Unit/Platform: ___________

Data Collector:_____________________

ENVIRONMENTAL DATA

		Start Event	*End Event*
Date/Time (Zulu):		__________	__________
Measurement Location	Long.	__________	__________
	Lat.	__________	__________
Environmental Conditions			
Air Temperature (C):		__________	__________

Wind Speed (knots):	____________	____________
Wind Direction:	____________	____________
Percent Cloud Cover:	____________	____________
Ambient Illumination (night):	____________	____________
Visibility (Nautical miles):	____________	____________
Humidity:	____________	____________
Sea State:	____________	____________
Sea Temperature (C)	____________	____________
Sea Depth (meters)	____________	____________
Ocean Current (knots)	____________	____________
Bottom Terrain	____________	____________

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